



INVESTIGATION OF GROUND WATER POLLUTION AT AIR FORCE PLANT NO. 4, FORT WORTH, TEXAS

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FOR UNITED STATES AIR FORCE OCTOBER 1986

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INVESTIGATION OF GROUND WATER POLLUTION AT AIR FORCE PLANT NO. 4 FORT WORTH, TEXAS

REPORT TO - UNITED STATES AIR FORCE

PREPARED BY U.S. ARMY CORPS OF ENGINEERS
KANSAS CITY DISTRICT
FORT WORTH DISTRICT

OCTOBER 1986

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ABSTRACT

Commencing in December 1982, Hargis and Associates, under a contract with General Dynamics Corporation, conducted an extensive investigation to determine the presence and extent of industrial chemical pollution at Air Force Plant No. 4. A major portion of this work was devoted to the testing of ground water flowing within the overburden. In addition, Harg's had 16 wells drilled to monitor for polluted ground water in the upper and middle zones of the Paluxy Formation. Paluxy ground water was monitored because the Formation is a principal water supply for the contiguous city of White Settlement. Hargis, in a letter to General Dynamics dated 12 April 1985, reported discovery of a concentration of 8,900 ug/l of trichloroethylene, 190 ug/1 of 1,2-trans-dichloroethylene, and lesser amounts of other chlorinated hydrocarbons, and the existence of abnormally high water levels in the upper zone of the Paluxy Formation in well P-8(U). In this letter, and again in the Phase II report of 1985, Hargis interpreted this information to indicate that chemically polluted ground water from the overburden was recharging the upper zone of the Paluxy aquifer beneath the east parking lot of the plant. In early May 1985, the Fort Worth District, Corps of Engineers, operating for Kansas City District Superfund, was asked to review existing data, investigate the distribution of chemical pollution within the Paluxy, and to locate the area in which polluted overburden ground water enters the Paluxy aquifer. The Corps proposed to drill six monitor wells into the upper zone of the Paluxy aquifer and five monitor wells into the alluvium mantling the bedrock, both groups of monitor wells to be located in the east parking lot of the plant. Also, the Corps proposed to have geophysical logs run in Paluxy monitor wells P-1 through P-4, and P-5(M) through P-10(M). These proposals were not implimented because of funding curtailment. The following investigative work was performed at the plant:

Three pairs of Paluxy monitoring wells were drilled along the south boundary of the plant to determine if pollutants discovered in well P-8(U) had reached the south plant boundary. One of each pair of these wells was completed in the upper zone of the Paluxy and the other was completed in the middle zone. Ground water was sampled in these wells and tested by Hargis and Associates. To date <u>none</u> of these wells appear to produce chemically polluted ground water. It is recommended that sampling and testing of ground water from all of the well pairs along the south boundary of the plant continue, preferably on a short-cycle basis. In addition to the drilling of 3 pairs of Paluxy monitoring wells, 28 exploratory borings were drilled in the east parking lot to obtain data for mapping topography of the eroded surface of bedrock in the area where the overburden might be in direct contact with the Paluxy aquifer. Exploratory drilling found that an erosion channel there does not penetrate the Paluxy Formation at any of the drill sites. A

sandstone bed, located immediately beneath the Walnut limestone and separated from the upper zone of the Paluxy aquifer below by 8 to 14 feet of shale, was recognized in geophysical logs of the monitor wells along the southern boundary of the plant, the geophysical log of exploratory boring 8A3F-110, and in short-interval cores in the area of predicted contact between the overburden and the Paluxy Formation, which became known as the "window." This sandstone may be the only member of the Paluxy Formation which becomes polluted in the "window" area. Since this has not been proved, it is recommended that two monitor wells be drilled immediately south of the "window" to test separately this uppermost Paluxy sandstone and the upper zone of the Paluxy aquifer proper. If these wells find pollution to be restricted to the uppermost Paluxy sandstone, it is recommended that additional monitor wells be drilled into the upper zone of the Paluxy aquifer in the vicinity of monitor well P-8(U) to determine whether and to what extent pollution has spread in the upper Paluxy zone proper from well P-8(U). It is also recommended that several monitor wells be completed in the overburden in the east parking lot to better define distribution of polluted ground water and to locate sand and gravel deposits in the erosional channel in the bedrock. Additionally, these wells may offer an opportunity to determine the velocity at which ground water moves through the overburden by injecting a nonhazardous dye tracer in selected wells.

INVESTIGATION OF POLLUTION OF GROUND WATER IN THE PALUXY AQUIFER AT AIR FORCE PLANT NO. 4, FORT WORTH, TEXAS

INTRODUCTION

- Pollution of ground water beneath Air Force Preceding Studies. Plant No. 4 was studied first by Hargis and Montgomery, Inc., then by Hargis and Associates, Inc. The problem being investigated was chemical pollution of ground water within the overburden. Monitoring and testing of ground water commenced with completion of well HM-1 in December 1982. D'Appolonia Waste Management Service conducted a refraction seismic survey in the east parking lot in 1983 in an effort to delineate topography of the eroded top of the bedrock in that area. The U.S. Environmental Protection Agency contracted four wells which were drilled in May and June 1983 to monitor ground water in the overburden. These wells are located in the city of White Settlement near the south and west boundaries of the plant. A record search to locate additional sites of buried industrial waste was made by CH2M Hill Company in 1984. The reader is referred to the following reports for details of other investigations of ground-water pollution at the plant:
 - a. Hargis and Montgomery Inc. 1983a, dated 3 February 1983.
 - b. Hargis and Montgomery, Inc. 1983b, dated 12 July 1983.
 - c. Hargis and Associates, Inc. 1984a, dated 12 October 1984.
 - d. Hargis and Associates, Inc. 1984b, dated 25 October 1984.
 - e. Hargis and Associates, Inc. dated 25 September 1985.

Monitor wells were drilled by Southwestern Laboratories, Inc., of Dallas, Texas for Hargis and Montgomery and Hargis and Associates. Ground water from monitor wells was sampled periodically by Hargis. Ground-water samples were tested for pollutants primarily by Brown and Caldwell Laboratories, Inc., of Bakersfield, California. Some testing was also done by Radian Corporation of Austin, Texas.

Hargis and Associates informed General Dynamics Corporation by a letter dated 12 April 1985, that a concentration of 8,900 ug/l of 190 concentration of trichloroethylene, а 1,2-trans-dichloroethylene and lower concentrations of other chlorinated hydrocarbons had been discovered in well P-8(U) monitoring the upper zone of the Paluxy. In this letter and again in the Phase II report of 25 September 1985, Hargis interpreted abnormally high water levels in well P-8(U) and normal water levels in well P-8(M) coupled with finding pollutants in the upper zone of the Paluxy to indicate that ground water from the overburden was probably recharging the upper portion of the Paluxy aquifer in an area east of the Assembly Building where the normally intervening Walnut Formation was believed to be missing. At the beginning of May 1985 the Air Force asked the Corps of Engineers to assist in determining the extent of pollution within the Paluxy Formation beneath the east parking lot in the vicinity of the Paluxy monitor well P-8(U) and to employ contractors to do remedial work if immediate action was required.

- Scope and Objectives. The Corps of Engineers was to review all 2. accumulated data bearing on pollution of the Paluxy Formation in the southeast part of the plant property. The Corps was then to develop a plan of investigation with the object of defining the limits of pollution within the Paluxy discovered by monitor well P-8(U) and to drill a number of exploratory borings to locate the area in which pollutants enter the Paluxy. The Corps plan included drilling and completing three pairs of Paluxy monitor wells along the southern boundary of the plant to discover if pollutants were present and moving beyond the south plant boundary toward the city of White Settlement. The Corps of Engineers proposed that an additional six monitor wells be drilled and completed in the upper zone of the Paluxy aquifer to aid in defining the pollution plume. The area in which pollutants were believed to enter the Paluxy Formation was to be investigated by the drilling of 20 exploratory borings which would also define bedrock topography. Additionally, five monitor wells were to be completed in the overburden in the east parking lot. Monitor wells P-1 through P-4 and middle Paluxy wells P-5(M) through P-10(M) were to have their pumps pulled and to have geophysical logs run in them to better resolve bedrock stratigrapy. Because of funding curtailment, the Corps drilled only 3 pairs of monitor wells along the south boundary of the plant and 28 exploratory borings in the east parking lot.
- 3. Local Geology. Air Force Plant No. 4, operated by General Dynamics

Corporation, Fort Worth Division, is situated on overburden immediately beneath which is a sequence of bedrock formations comprised of limestone, shale, and soft sandstone, all of Cretaceous age. The deepest of these formations which are relevant to this investigation is the Glen Rose Formation consisting principally of limestone. Depth of the Glen Rose limestone varies within the plant area from 213 feet in well P-1 to 236 feet in exploratory boring 8A3F-110. Above the Glen Rose, in ascending order, are the Paluxy Formation, the Walnut Formation, and the Goodland Formation.

a. Stratigraphy.

of sandstone which varies from nearly uncemented sand to moderately cemented sandstone. The formation also contains a number of shale beds, most of which range from a thickness of less than 1 foot to as much as 5 feet. The top of the Paluxy Formation is defined as the first sandstone encountered beneath shale or limestone of the overlying Walnut Formation. The Paluxy has been divided into three zones. The lower zone, immediately overlying the Glen Rose Formation, is comprised of a number of sandstone beds separated from each other by beds of shale from less than 1 foot thick to as much as 7 feet thick. Two geophysical logs of this zone in the city of White Settlement indicate that much of the sandstone is somewhat shaly or clayey. The zone is quite consistent in total thickness throughout the plant/White settlement area. Because of

the presence of beds of shale and shaly sandstone, the lower zone of the Paluxy probably contributes less ground water to water supply wells within the city of White Settlement than does the middle zone.

The middle zone of the Paluxy has a relatively small shale or clay content. This unit is the uppermost Paluxy unit in which White Settlement city wells are completed. The middle zone of the Paluxy Formation is quite recognizable on geophysical logs of wells in this area. For examples of this see Plate 1 which is a correlation diagram in the plant/White Settlement area utilizing geophysical logs.

Water wells producing from the Paluxy Formation in the city of White Settlement are not completed in the upper zone of the Paluxy because of its low productivity. The upper zone of the Paluxy varies in composition significantly more in the proportion of sandstone and shale which comprise this zone in the area of Plant No. 4 and the city of White Settlement than does either the middle or the lower zone. In White Settlement, well No. 8, 19 feet of Walnut shale separates the Walnut limestone and the Paluxy sandstone. Only 0.5 to 1.5 feet of shale separates these beds in the plant area. The upper Paluxy zone is comprised of individual sandstone beds and of sub-zonal units consisting of a number of sandstone beds. The sub-zonal units are separated from each other by shale beds. These sandstone units vary in thickness from about 13 feet to 20 feet. Individual sandstone beds vary from a thickness of about 1 foot to as much as 8 feet.

- Walnut Pormation. Regionally the Walnut Formation is (2) comprised principally of shale which has a medial shelly limestone This member is the Walnut limestone described in earlier member. reports of investigation at the plant. The medial limestone member of the Walnut is approximately 30 feet thick in the plant/White Settlement area. Any shale present separating this member from the first Paluxy sandstone below is classified as belonging to the Walnut Formacion. The Walnut also has a shale member overlying the Walnut limestone in this area which is approximately 20 feet thick. This shale has, on rare occasions, been classified as belonging to the Goodland limestone Formation above it, but regionally it belongs to the Walnut Formation. This shale contains a few feet of impure limestone in its middle This part of the Walnut Formation can be seen on the portion. geophysical and strip-log of White Settlement well No. 8 on Plate 1.
- (3) Goodland Formation. The Goodland Formation overlies the Walnut shale. It is composed of limestone containing a few thin shale beds. Its total thickness is approximately 80 feet near the plant. Only a few feet of the basal part of the formation are present in the bedrock sequence beneath the plant because of erosion of its outcrop. Limestone comprising this formation is present beneath the plant only where the overburden is thin and bedrock is relatively near the surface. These conditions prevail mainly along the southern boundary of the plant property.

- (4) Overburden. Alluvium mantling the eroded surface of bedrock beneath the plant has been called the upper zone in reports by Hargis and Montgomery, Inc., and by Hargis and Associates, Inc. This material is referred to here as overburden. Overburden in this immediate area consists primarily of clay, some of which is sandy and gravelly, but it contains channel deposits of sand and gravel as well.
- b. Structure. Geologic structure in the shallow Cretaceous bedrock above the top of the Glen Rose Formation consists principally of gentle regional dip slightly south of east at approximately 30 feet per mile. Formational dip places the base of the Walnut limestone at between elevation 582 and elevation 587 along Grants Lane and at elevation 600 to elevation 602 in the vicinity of monitor wells P-10(U) and P-10(M) near the unnamed creek west of Bomber/Meandering Road west of the plant.

c. Aquifer Bydrology.

(1) Overburden. Ground water within the overburden flows in two general directions on top of the eroded bedrock in the plant area. A divide area of relatively high bedrock extends approximately north-south in the general area of the Parts Plant Building (No. 5) northward from about the location of Warehouse No. 1. West of this subsurface divide, overburden ground water flows toward the unnamed creek west of Bomber Road. East of the divide, ground water flows to the east, then to the north, down at least two buried channels eroded into the top of the bedrock.

(2) Paluxy Upper Zone. Many water levels in wells completed in both the upper and middle zones of the Paluxy aquifer are at elevations below the top of the upper zone of the aquifer. In wells P-8(U) and P-10(U) completed in the upper zone, early water levels were 19 and 21 feet higher than water levels in their companion wells P-8(M) and P-10(M) completed in the middle zone of the Paluxy, suggesting recharge of the upper zone of the Paluxy aquifer in the vicinity of the wells. Contours on elevations of water levels in monitor wells completed in the upper zone of the Paluxy aquifer are shown on Plate 2. The contours are drawn on few data. These piezometric data are not well distributed for purposes of hydrologic interpretation. However, it is known that the upper zone of the Paluxy aquifer is recharged through outcrops of this zone in the bottom of Lake Worth, immediately north of the plant where the lake is oriented east-west. Contours in areas of closest well data suggest that ground water in this zone probably flows nearly due south, except for anomalies. Contours around well P-10(U) have been drawn to suggest that recharge may be occurring in the bottom of the unnamed creek west of Bomber/Meandering Road. This was done because of the anomalously high water level in well P-10(U) next to the creek. Anomalously high water levels in the upper zone of the Paluxy in well P-8(U) coupled with the discovery of chemical pollution in water from Paluxy monitor well P-8(U) and water from overburden monitor wells such as HM-82 gave rise to Hargis' interpretation that overburden ground

water containing chemical pollution was in hydraulic contact with the upper zone of the Paluxy Formation and was actively recharging the upper zone of the Paluxy aquifer. That part of the channel eroded into the bedrock in which contact between the overburden and sandstone of the Paluxy aquifer was believed to exist has been called the "window." The "window" was believed to be located under the east parking lot of the plant, southeast of Engineering Building 200.

(3) Paluxy Middle Zone. Plate 3 shows contours on elevations of water levels in the middle zone of the Paluxy aquifer. Water level contours from the relatively few monitor well data in the middle zone of the Paluxy as drawn suggest a flow direction of south 30° east in this The water level elevation data contour smoothly, and 5 foot contours are more widely separated than are those of the upper zone of the Paluxy aquifer. These conditions suggest that the middle zone here may be more remote from its source of recharge than is the upper zone. The flow direction indicated by the contours seems to indicate that the recharge area of the middle zone is farther upstream in Lake Worth than is that of the upper zone. This appears to be in accord with regional structure of the Paluxy Formation. Since the Paluxy Formation dips (inclines) eastwardly, it also rises to the west. The middle zone of the formation is not known to crop out in the bottom of Lake Worth along the north boundary of the plant. It may crop out in the lake bottom north and west of the plant.

PLAN OF INVESTIGATION

- 1. Paluxy Monitor Well Program. Initial action by the Corps of Engineers was to drill and complete three pairs of monitor wells on an east-west line along the south plant boundary. The well pairs were located 500 feet apart. Wells P-11(U) and P-11(M) were completed in the middle of the south end of the east parking lot. Wells P-12(U) and P-12(M) were located in the alley along the south side of General Warehouse Building No. 188. The well heads were placed in small concrete vaults beneath the alley paving. The vaults were covered by removable steel cover plates to permit vehicle traffic, yet easy access to the well heads and protection from entry of rain runoff into the wells. Wells P-13(U) and P-13(M) were completed 80 to 90 feet south of the line of P-11 and P-12 well pairs. P-13(U) and P-13(M) are located just off the concrete apron approximately 120 feet south of the southwest corner of Run Station No. 1. Zonation of the Paluxy Formation used for completion of these wells was tailored to match that employed by Hargis and Associates. purpose of the well pairs was to discover if pollution within the Paluxy aquifer had reached the south boundary of the plant in the upper or middle zones of the Paluxy.
- a. Well Drilling and Construction. Well drilling and completion procedures employed were similar to those used by Southwestern Laboratories in their work for Hargis and Associates. Of the three wells completed in the upper zone of the Paluxy along the southern

boundary of the plant, only well P-12(U) was completed to include the uppermost sandstone immediately beneath the Walnut limestone. casing program used for completions in the upper zone of the Paluxy involved steel casing through the Walnut limestone. However, only a 14-inch diameter hole was drilled in this section into which 10-inch steel casing was set, centralized, and cemented from the bottom of the casing to the ground surface. A 9-7/8-inch diameter hole was then drilled from the bottom of the 10-inch casing to total depth of the well into which was set 4-inch centralized, schedule 80 PVC casing, at the bottom of which was 20 feet of 4-inch I.D., 0.010 slot PVC well screen, plugged at the bottom. Filter sand was placed in the annulus around the 4-inch casing, extending upward into the steel casing. A 2-HP, 8 gpm, 2-7/8-inch diameter, 20 stage, single phase, Model 2x4 P050 submersible pump, manufactured by the Standard Pump Company of Bartlesville, Oklahoma, was installed in each well for water sampling. A 14-inch hole was drilled through the upper zone of the Paluxy into the uppermost part of the middle zone of the Paluxy and cemented to the surface in wells completed in the middle zone. As in wells completed in the upper zone, a 4-inch PVC casing and 20 feet of 4-inch PVC screen was set and sand packed in the test interval of the middle zone. The same model submersible pump was installed in all wells, regardless of the zone they were completed in.

A black substance was encountered while drilling cement remaining in

the 10-inch casing of well P-13(M) after the casing cement had set. It was found to be gilsonite, a powdered material used to prevent lost circulation while cementing. It was not known if this material had been incorporated in cement behind the casing, but this circumstance was assumed as a "worst case." Samples of this material, recovered during drilling cement in the casing, were analyzed by Southwestern Division Laboratory of the Corps of Engineers in Dallas, Texas, to determine if any toxic substances were present. Additional samples of this material were obtained from the Western Company of North America, the well cementers, and were sent to Hargis and Associates to be exposed to dissolution by a solution of trichloroethylene (TCE) in a concentration similar to that discovered in ground water from well P-8(U). Tests were run to determine first, whether the gilsonite would go into solution; and second, whether any toxic substances would be produced in the process of dissolution. Test results from both laboratories were negative, allowing further operations in the well. Incorporation of gilsonite in the casing cement also raised a question as to the integrity of the casing cement. Western Company of North America pressure tested the well with water under 200 psi and then retreated the well with an additional 75 sacks of neat cement slurry with a surface pressure of 150 psi at their expense. Logging of the Paluxy monitor well pairs was done initially from drill cuttings, as were Paluxy wells P-1 through P-10. In addition, an electric log was run in the open hole

(before setting 4-inch PVC casing) and a gamma ray log was run through the entire hole to produce a log which included the portion of the well where steel casing was set. Though the commercial logs run in the first wells drilled, P-11(U) and P-11(M), were of poor quality, it became obvious very soon that the logs made from drill cuttings from beds below the base of the Walnut limestone did not agree well with the electric and gamma ray logs of the same section of bedrock. A variety of reasons account for this, most of which are related to the soft nature of the bedrock which, when drilled, would break sandstone down to sand grains instead of sandstone chips, and shale into discolored drilling fluid instead of shale chips of sufficient size for recognition. Because of the difficulty in obtaining good logs from drill cuttings, considerable reliance was placed on geophysical logs of the Paluxy monitor wells along the southern property line of the plant. The most desirable features of geophysical logs, compared with drill cutting logs, are the greater degree of resolution of individual beds and small units and the curve character which results in characteristic signatures of each formation, aiding correlation. All of the Paluxy monitor wells were developed by airlift pumping and surging. Each well was pumped by airlift, followed by a brief lowering of the air supply line below the eductor pipe to blow the well with compressed air, followed by an immediate return to airlift pumping. This cyclic activity was repeated every 15 minutes for a total development period of 4 hours.

Well Water Sampling and Testing. All sampling and testing of

ground water from Paluxy wells P-11(U) and (M), P-12(U) and (M), and P-13(U and M), was done by Hargis and Associates as part of their continuing program of ground water monitoring. Table 1 lists tests which found pollutants. Other unpolluted tests are included to indicate changes where pollution disappeared. Reproductions of test reports are located in the Appendix at the end of this report. The finding of methylene chloride and toluene in water samples from Paluxy monitor well P-11(U) followed by a 6-month period of unpolluted tests is interpreted to mean that the upper zone is probably unpolluted. Tests of water samples from well P-11(M) have contained no pollutants to date indicating that the middle zone of the Paluxy probably is unpolluted at the site of well P-11(M). Tests of water from well P-12(U) found oil and grease on 12 December 1985 and again on 9 January 1986. This material probably was present only in limited amounts because subsequently it disappeared from tests of water from the well. It may have come from the rig that drilled well P-12(U). 0n 9 January 1986, 62 ug/1 1,1,1-trichloroethane was found in P-12(U). This pollutant was found again in concentration of 56 ug/1 on 6 April 1986. The same pollutant was found on 9 July 1986, but in a concentration of only 7 ug/1. trend of diminishing concentrations of 1,1,1-trichloroethane suggestive that the upper zone of the Paluxy is unpolluted, and that this chemical may have been introduced during drilling. The presence of only one contaminant is considered unusual. Generally two or more

TABLE 1
TEST RESULTS

| | Test Date or Receiving | |
|----------|------------------------|--|
| Well No. | Date | Concentration Pollutant |
| P-11(U) | 9-05-85 | 15 ug/l Methylene |
| | | Chloride |
| | 9-05-85 | 64 ug/l Toluene |
| | 10-10-85 | 70 ug/l Toluene |
| | 1-08-86 | Purgeable Priority Pollutants - all below |
| | | detection level. |
| | 4-05-86 | Same |
| | 7-10-86 | Same |
| P-11(M) | No pollutants | detected between 8-29-85 and 7-22-86. |
| P-12(U) | 12-12-85 | 32 mg/l Oil and Grease |
| | 12-12-85 | Purgeable Priority Pollutants - all below |
| | | detection level. |
| | 1-09-86 | 9 mg/l Oil and Grease |
| | 1-09-86 | 62 ug/l l,l,l-Trichloro- |
| | | ethane |
| | 4-06-86 | 56 ug/l l,l,l-Trichloro- |
| | | . ethane |
| • | 7-09-86 | 7 ug/1 l,l,1-Trichloro- |
| • | | ethane |
| P-12(M) | 10-10-85 | First Purseehla Priority Pollution tost - 11 |
| F-12(H) | 10-10-03 | First Purgeable Priority Pollution test - all below detection level. |
| | 7-09-86 | 5 ug/1 1,1,1-Trichloro- |
| | 7 07 00 | ethane |
| | 7-09-86 | 2 ug/l 1-1-Dichloroethane |
| | | |
| P-13(U) | 4-09-86 | First Purgeable Priority Pollutant test - all |
| | | below detection level. |
| | 5-07-86 | 0.17 mg/l lead - 0.12 mg/l above |
| | r 03 04 | maximum permissible concentration |
| | 5-07-86 | 0.06 mg/l - Manganese - 0.01 mg.1 |
| | | above maximum permissible concen- |
| | 5-08-86 | tration. |
| | | 8 ug/l Methylene Chloride |
| • | 6-05-86 | 0.06 mg/l lead - 0.01 above maxi- |
| | 6-05-86 | mum permissible concentration |
| | 0-03-00 | Purgeable Priority Pollutants - all below detection level. |
| | 7-09-86 | |
| | 7-03-00 | Purgeable Priority Pollutants - all below detection level. |
| P-13(M) | 8-06-86 | Tests for oil and grease and for total fuel. Hyd |
| | | carbons - all below detection level. |
| | 8-06-86 | Purgeable Priority Pollutants - all below detecti |
| | | level. |
| | 8-06-86 | B/NA Priority Pollutants - all below detection |
| | 0-00-00 | 1 and |

level.

contaminants are found when an aquifer is polluted. This well should continue to be sampled and tested to build a larger body of test data. Well P-12(M) produced water with only 5 ug/l of 1,1,1-trichloroethane and 2 ug/l of 1,1-dichloroethane on 9 July 1986. Since water from this well has only been sampled and tested once, no conclusion can be reached concerning pollution of the middle zone at the location of the well. This well should continue to be tested to build a body of test data. Only minor concentrations of pollutants have been found in water samples from well P-13(U) to date. Traces of lead and manganese and a low concentration of methylene chloride, found during the initial 3-month period of testing, does not suggest that the upper zone of the Paluxy is polluted at the location of the well. This well should continue to be monitored. Sampling and testing of well P-13(M) so far indicates that no pollutants are present in the middle Paluxy here. Ground water from this well should continue to be sampled and tested.

A test of interzonal communication was conducted in the Paluxy wells P-12(U) and P-12(M). The middle zone was continuously pumped at 8 gpm in well P-12(M) for a period of 3 hours. Water levels were measured in well P-12(U) throughout this period. No drop in water level of P-12(U) was experienced during the test period. Though this test suggests lack of communication between the upper and middle zones of the Paluxy aquifer at this location, the test is not considered to be conclusive. Only unchanging water levels, measured in well P-12(U) during pumping of

well P-12(M) at a much greater rate, sustained over a much longer period, can reasonably demonstrate lack of communication between the upper and middle zones of the Paluxy Formation.

c. <u>Safety Procedures</u>. Hazards to drilling personnel were assessed at the beginning of field operations. It was determined that risk was at EPA Level D (minimal). Optional rubber gloves were used by drilling personnel where needed in addition to other protective clothing specified for Level D risk.

The Failing 1500 drill and all tools used in drilling the Paluxy monitor wells were steam cleaned after completing each well. drilling fluids and cuttings, including augered materials, were collected and segregated in containers specifically for this purpose. The collected materials were sampled, and the samples were tested for the presence of purgeable priority pollutants. Results of these tests determined whether or not the materials required disposal in a toxic waste dump. The collected materials were turned over to General Dynamics Corporation for disposal based on test documentation supplied at the material transfer. Initially, collected surplus drilling materials were tested for volatile organic compounds as a slurry with a gas chromatograph using EPA Method 601. Subsequently, all materials were tested by gas chromatography/mass spectrometry by EPA Method 624 which tests for a greater range of compounds. Nearly all of the materials removed from the exploratory borings were products of

augering. Since no permanent installation was made in these borings, these materials were used to backfill the holes. Any surplus was collected, tested, and disposed of as were materials derived from drilling wells.

- 2. "Window" Investigation. The site of the erosion channel in which the "window," as interpreted by Hargis and Associates, was believed to exist, is the east parking lot primarily in an area near Grants Lane, southeast of Engineering Building 200.
- a. <u>Drilling Plan and Procedures</u>. A plan of boring and section locations is shown on P'ate 4. The drilling program designed to discover the location of the "window" was one of obtaining subsurface topographic data on the top of bedrock in the area of the east parking lot. Data on lithology of the uppermost bedrock were obtained as an integral part of the drilling. Drilling of borings 8A4C-83 through 8A4C-86 early in the investigation, before the drilling of Paluxy wells was well advanced, proved inconclusive in finding the "window" which is the location where overburden alluvium is in contact with sandstone of the Paluxy aquifer. Borings 8A4C-84 through 8A4C-86 found bedrock to be comprised of Walnut limestone, the top of which was at about the same elevation in all three borings. Drilling of exploratory borings was resumed after completion of all Paluxy monitor wells but P-13(M). This effort took the form of laying out four rows of potential exploratory boring locations from which to select those for drilling based on

The rows of locations were laid out east-west. parallel to station lines of the plant survey grid. Drilling results from each row were portrayed as geologic sections on plates 6 and 7. Borings at the east end of each row, plus other borings near the eastern boundary of the east parking lot, formed an additional row and were used to construct geologic Section E-E', shown on plate 8. As drilling proceded on rows D-D' and E-E', additional borings were drilled between the first borings to reduce the risk of failing to encounter any erosional channel in the bedrock which might penetrate the Paluxy Formation and constitute a "window" through which polluted ground water from the overburden might enter the Paluxy aquifer. One boring, 8A3F-110, was drilled and logged geophysically to obtain stratigraphic information on the basal Walnut limestone and the whole of the Paluxy formation beneath the Walnut. See Plate 4 for locations of monitor wells, exploratory borings, and geologic sections in the southeastern portion of the plant..

b. Drilling Results.

- (1) Overburden Composition. Alluvium comprising the overburden consists of clay, sand, and gravel with some of these materials of somewhat mixed composition. The materials are shown on Sections A-A' through E-E' on Plates 6 through 8, and on logs of all wells and exploratory borings located in the Appendix at the back of this report.
 - (2) Bedrock Brosional Topography. Topography of the eroded top

of the bedrock is shown in plan on Plate 5, and in section on Plates 6, 7, and 8. Bedrock topography of direct concern to the site of a "window" is that of an erosional channel in the bedrock commencing near the south end of Warehouse No. 12. The channel extends eastward and "downstream" under Process Building No. 181, Materials Storage Building No. 182 to the northwest corner of General Warehouse Building No. 188 where it turns to the northeast. From Building No. 188 the channel extends across the east parking lot to the site of plugged overburden well HM-67, adjacent to Grants Lane and west of Field Operations support Building No. 189. Data from exploratory borings drilled in this investigation and from foundation borings drilled for plant construction suggest that a relatively flat bedrock exists between boring 8A-105 and Engineering Building No. 200, which includes the area beneath the Field Operations Building and Grants Lane. Elevations of the bedrock here range from 585 to 590. Any deeper erosional channel that may exist, eroded into this relatively flat area, may take a course similar to that suggested by the 595-foot contour on Plate 5.

(3) <u>Bedrock Stratigraphy</u>. The stratigraphic sequence of the lower portion of the Walnut formation and the uppermost portion of the Paluxy Formation is shown on Sections A-A' through E-E' on Plates 6, 7, and 8. Stratigraphy of these formations in the form of five geophysical logs with strip logs showing rock types is also shown on Plate 1, which is a bed.ock correlation diagram. Wells numbered H-4 and 8, shown on

Plate 1, are located in the city of White Settlement. Also shown on Plate 1 are monitor wells P-12(M) and P-13(M), which are located along the south boundary of the plant. Stratigraphic boring 8A3F-110, on the right side of Plate 1, is north of monitor wells P-8(U) and P-8(M) in the east parking lot. See Plate 4 for the location of monitor wells and exploratory borings.

Good samples of the uppermost sandstone of the Paluxy Formation, which occurs imediately beneath the Walnut limestone, were obtained by short-interval coring of exploratory borings 8A4C-102 and 8A4C-103. (These borings are shown on Sections D-D', Plate 7, and E-E', Plate 8). Core of the uppermost sandstone was found to be very fine-grained and probably silty. Permeability of this core was not tested, but based on visual appearance, the sandstone has low permeability for a sandstone. Likewise, core of 2.4 feet of the top of the Paluxy aquifer proper from exploratory boring 8A4C-102, and core of the upper part of the upper zone of the Paluxy formation in monitor well P-13(M) was also fine-grained and apparently has low permeability. A gradual downward trend of increasing coarseness of the sandstone of the upper zone of the Paluxy was observed in core from well P-13(M). Boring 8A4C-102 in Section D-D', shows the shallow bedrock sequence logged from 4-inch core. It is to be noted that the log of plugged well HM-67, shown in this section, indicates a unit entirely of shaly clay/claystone. This description is not one normally applied to overburden in this area.

Such a description may indicate either a channel filled with clay, developed during deposition of the Paluxy Formation, or more likely difficult logging of drill cuttings. Section E-E' contains a log of boring 8A4C-103 which shows 3.5 feet of clay shale overlying the basal 1.1 feet of the Walnut limestone. It is unlikely that this material is part of the bedrock and is not shown to be as this portion of the Walnut Formation consists entirely of limestone. It may be that this material is stream-transported, weathered shale which came from bank-sloughing either upslope or upstream. The logging of approximately 9.6 feet of clayey shale in the bottom of well HM-71, shown on Section E-E' on Plate 8, is questioned. Again, this material is in the position normally occupied by the Walnut limestone in this area. The descriptive name "clay shale" is not one which is normally applied to alluvium in this area.

In almost all of the exploratory borings and monitor wells in and near the east parking lot of the plant, the first bedrock encountered is limestone which belongs to the Walnut or Goodland Formations. The base of the Walnut limestone is shown on the geologic Sections B-B', C-C', D-D', and E-E' (Plates 6 through 8). The sources of data on this stratigraphic horizon are exploratory borings 8A4C-85, 8A4C-102, 8A4C-103, 8A3F-110, and monitor wells P-2, P-9(M), and well pairs P-6, P-7, and P-11.

The logs shown on Plate 1 indicate that at least 50 percent of the

uppermost 14 to 18 feet of the Paluxy Formation is comprised of shale, the remainder of which is comprised of sandstone. The stratigraphic sequence in this portion of the Paluxy, downward from the base of the Walnut limestone, is as follows: 0.5 to 1.5 feet of shale; 2.6 to 8.0 feet of Paluxy sandstone; and 8.0 to 13.8 feet of Paluxy shale. Thicknesses of these units show the major variations to be expected in the area between well H-4 in the city of White Settlement and boring 8A3F-110 in the east parking lot of the plant. The upper zone of the Paluxy aquifer proper commences beneath the last shale listed above. Logs shown on Plate 1 also indicate that individual lithologic members comprising the uppermost 14 to 18 feet of the Paluxy Formation probably persist throughout the area encompased by the well/boring logs. most prominent lithologic variation in this part of the Paluxy, shown on Plate 1, is the pinchout of the uppermost sandstone between well H-4 and well number 8 in the city of White Settlement. Core from exploratory borings 8A4C-102 and 8A4C-103, shown on Plate 7, confirm stratigraphic sequence interpreted from the geophysical logs.

Monitor wells P-8(U) and P-8(M) are located in the east parking lot between the line of monitor well pairs P-11, P-12, and P-13, and exploratory borings 8A3F-110 and 8A4C-102. Existence of the consistent stratigraphic section in the uppermost Paluxy in these wells and borings suggests that the shale member separating the uppermost Paluxy sandstone from the upper zone of the Paluxy aquifer proper below probably was not

seen and logged in drill cuttings from P-8(U) and P-8(M).

That portion of Section D-D' on Plate 7 between exploratory boring 8A4C-102 and monitor well HM-67, and the portion of Section E-E' on Plate 8 between exploratory borings 8A-105 and 8A4C-85 show the lowest elevations of the channel. This is the area where the "window" was believed to be located. None of the exploratory borings in the area found the erosion channel to penetrate the Paluxy Formation. In all borings but plugged monitor well HM-67 lithology of the channel bottom is Walnut limestone. However, only 1.1 feet of Walnut limestone was present in boring 8A4C-103. The correlation line depicting the base of the Walnut limestone between well P-9(M) and boring 8A4C-102 on Section D-D' (Plate 7), indicates that the Walnut limestone probably is only 1-foot thick at the location of boring 8A-107. The drill cutting log of monitor well HM-67 (Sections D-D' and E-E') suggests that no Walnut limestone is present above the Paluxy Formation at the location of the well.

(4) Bedrock Hydrology. No hydrostatic data were collected from the Paluxy Formation during the drilling of exploratory borings in the east parking lot due to funding curtailment. The six monitor wells, which were to have been completed in the upper zone of the Paluxy, and five monitor wells, which were to have been drilled in the "window" area were expected to define the hydrologic relationship between the overburden and the Paluxy aquifer in this area. Though the desired

hydrologic data were not obtained, possible hydrologic conditions in the "window" area are interpreted from stratigraphic relationships described in the preceding Section 3, Bedrock Stratigraphy. Hydrologic interpretations are made here because: (1) hydrologic conditions in the "window" are pertinent to determining how much thickness of the Paluxy Formation contains polluted ground water and; (2) these interpretations form the basis for a recommendation for future action which appears at the end of this report.

None of the exploratory borings in the east parking lot found the channel located there to have been eroded deeply enough into the bedrock to have penetrated the Paluxy Formation. However, the 1+ foot of Walnut limestone at exploratory boring locations in the relatively flat area comprising the bottom of the channel north of boring 8A-105 (Plates 5 and 8) is missing in monitor well HM-67. It is considered likely that erosion has caused the channel to be incised as much as 5 to 10 feet into the Paluxy sequence of beds in the flat-bottomed area of the "window" near Grants Lane, north of monitor well HM-67, penetrating the uppermost Paluxy sandstone. It is doubted that the channel is eroded as deeply as 15 feet into the Paluxy Formation in the "window" area, which would reach the top of the sandstone of the Paluxy aquifer proper and allow entry of polluted overburden water into the aquifer.

If the channel penetrates the uppermost Paluxy sandstone in the "window" north of the area explored as anticipated, the sandstone will probably be charged with polluted ground water from the overburden. If

the channel does not penetrate the upper zone of the Paluxy aquifer proper, the aquifer should be free of pollution. Since the top of the test interval of monitor well P-8(U) is at the base of the Walnut limestone, the test interval hydraulically connects the uppermost sandstone with the upper zone of the Paluxy aquifer. Connecting these two units renders uncertain the meaning of any water level measured in the well. Given presently available data, it appears possible that only the uppermost Paluxy sandstone in the east parking lot area is recharged with polluted ground water originating in the overburden. This ground water is believed to be entering monitor well P-8(U), causing high water levels. It is also believed that this ground water descends in the well and enters the upper zone of the Paluxy aquifer. The speculations just presented have not yet been proved by the construction and testing of requisite monitor wells. If the conditions suggested prove to be correct, it should be possible to establish that only the uppermost Paluxy sandstone contains polluted ground water and that the upper and middle zones of the Paluxy aquifer are not in danger of being polluted in all of the east parking lot but the area immediately around monitor well P-8(U).

CONCLUSIONS

1. Alluvial overburden was not found to be in contact with the uppermost sandstone of the Paluxy Formation or with sandstone beds comprising the upper zone of the Paluxy aquifer proper in any well or exploratory boring drilled in this investigation. However, only a

minimum of approximately 1 foot of limestone and 0.5 foot of shale separates the overburden and the uppermost Paluxy sandstone in the "window" area.

2. The uppermost sandstone of the Paluxy Formation is separated from the upper zone of the Paluxy aquifer proper, which underlies it by 8 to 14 feet of shale in all wells and exploratory borings which have been logged geophysically or have been cored through this stratigraphic interval in the east parking lot of the plant and in water supply well H-4 in the city of White Settlement.

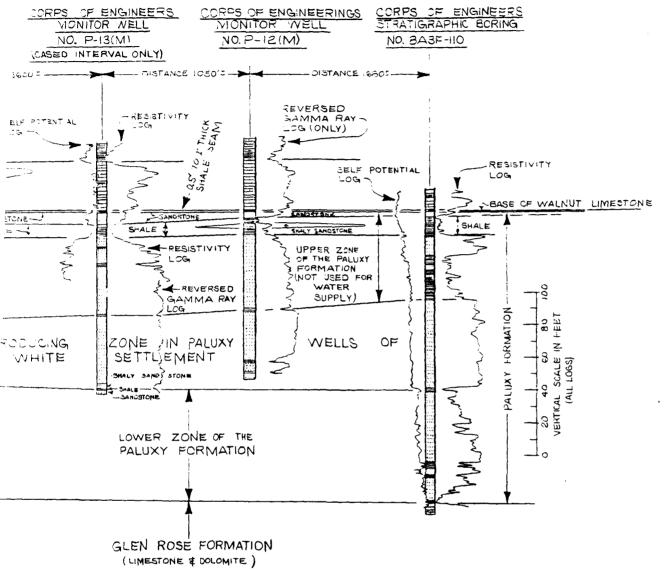
RECOMMENDATIONS

- 1. It is recommended that ground water from Paluxy monitor wells P-11(U), P-11(M), P-12(U), P-12(M), P-13(U), and P-13(M), continue to be sampled and tested for the presence of pollutants, preferably on a short-cycle basis.
- 2. It is recommended that two monitor wells be drilled to test separately the uppermost sandstone bed and the upper zone of the Paluxy aquifer proper. These wells should be located just outside the south edge of the "window" area so that at least 5 feet of Walnut limestone will be present in which to set steel casing, better isolating the test interval from the overburden above. The intent of this recommendation is to determine whether pollution is limited to ground water in the uppermost sandstone unit of the Paluxy Formation.
- 3. If pollution proves to be confined to the uppermost Paluxy sandstone by drilling and testing the recommended wells, it is further recommended

that additional monitor wells be completed in the upper zone of the Paluxy aquifer in the vicinity of existing monitor well P-8(U) to determine whether and to what extent pollution has spread from that well in the upper Paluxy aquifer proper.

4. It is also recommended that several monitor wells, completed in the overburden, be drilled in the east parking lot to better define the distribution of polluted ground water and to locate sand and gravel deposits in the erosional channel in the bedrock. In addition, these wells may offer an opportunity to determine the velocity at which ground water moves through the overburden by injecting a nonhazardous dye tracer in selected wells.

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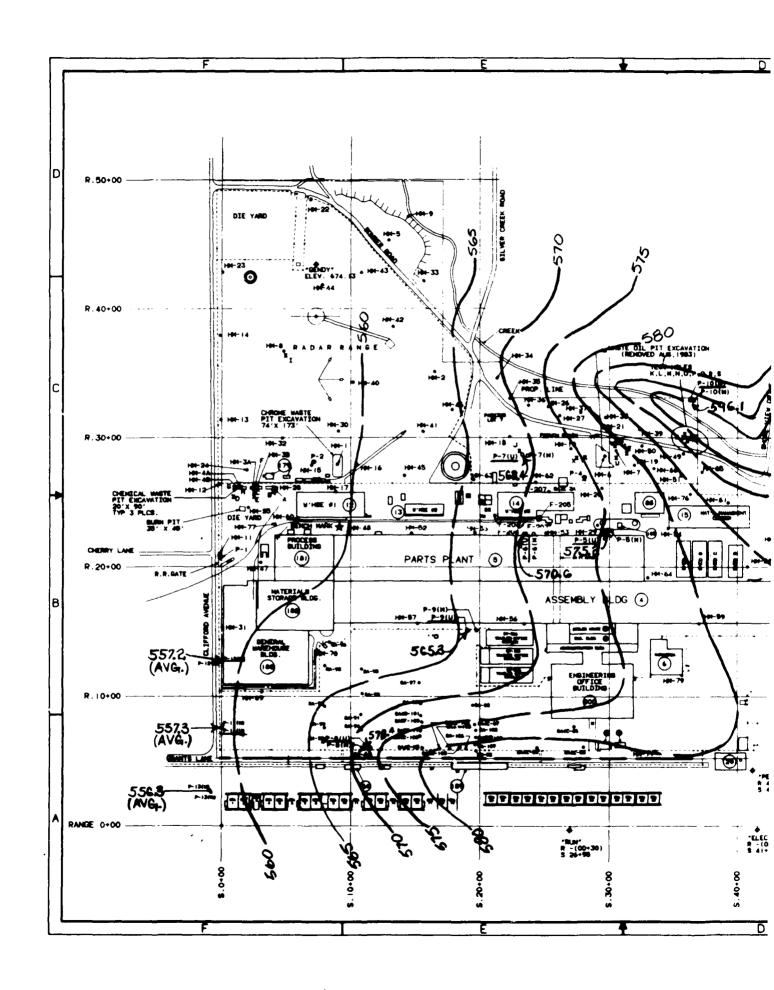
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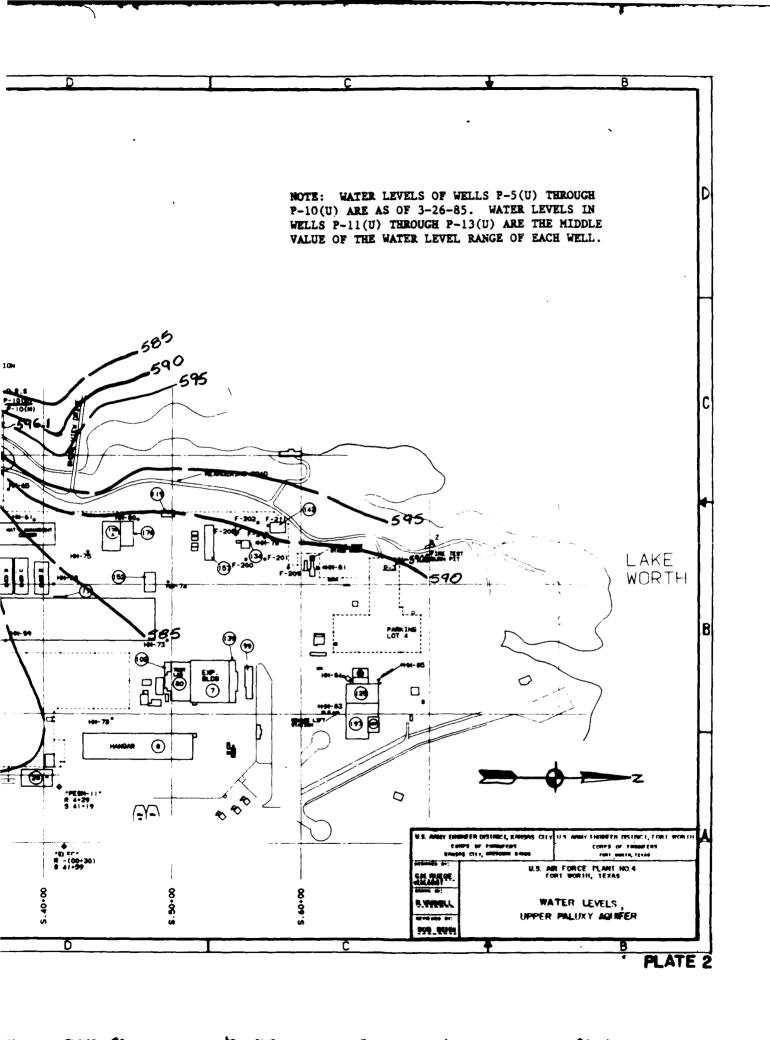
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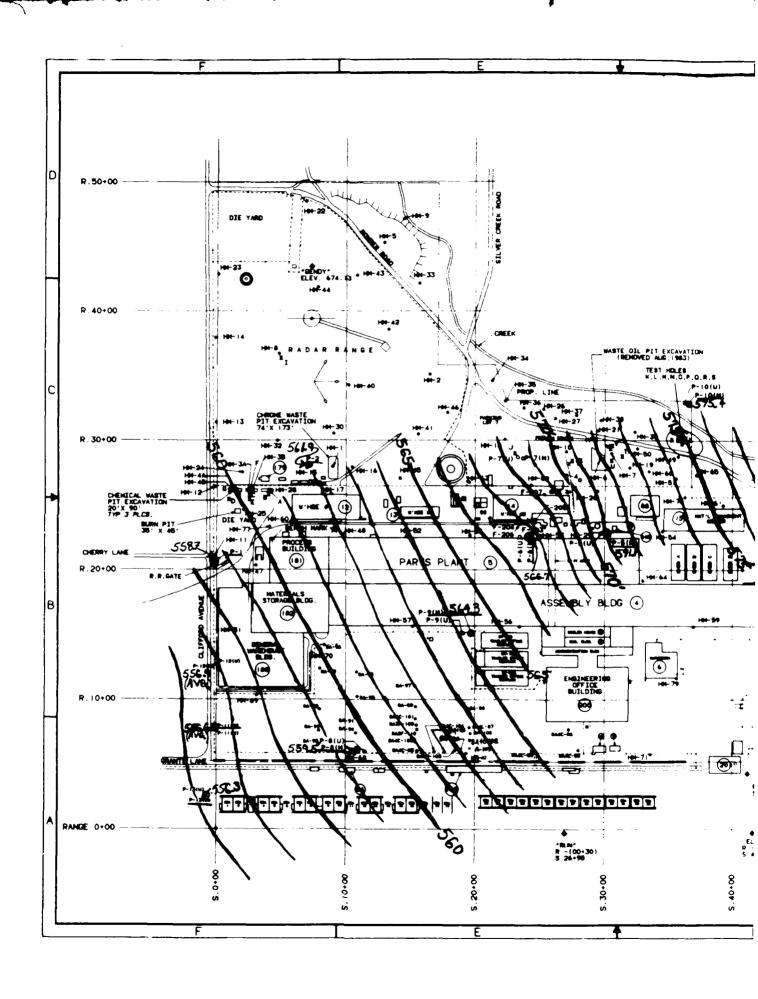
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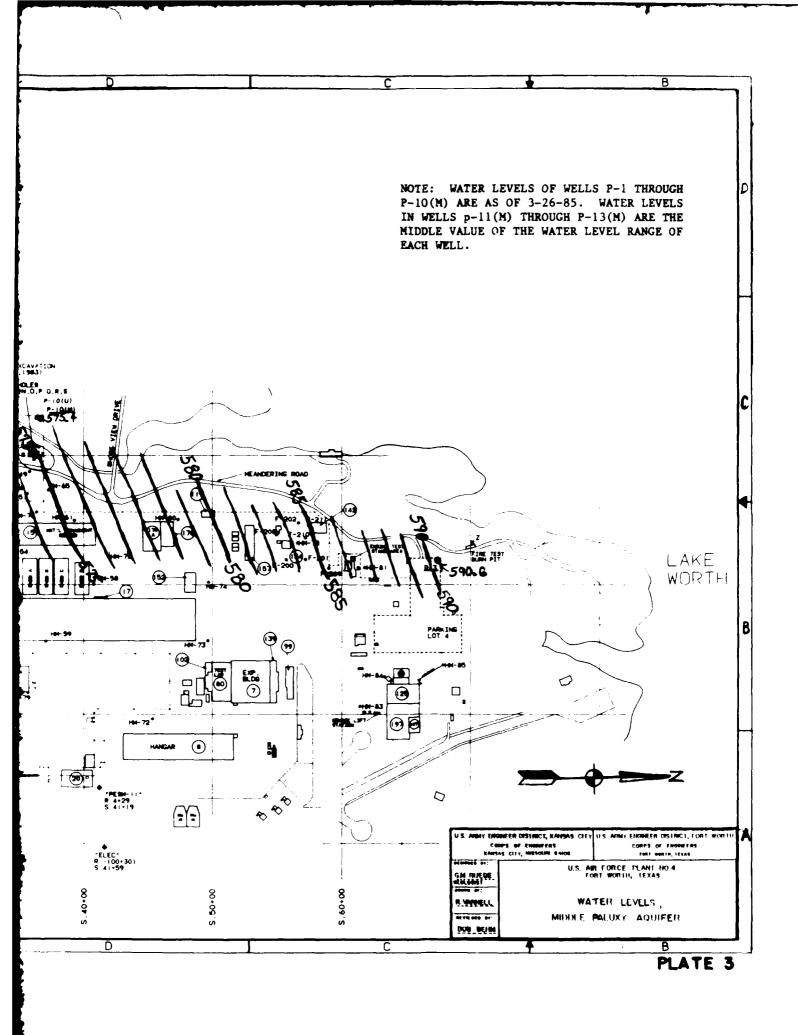
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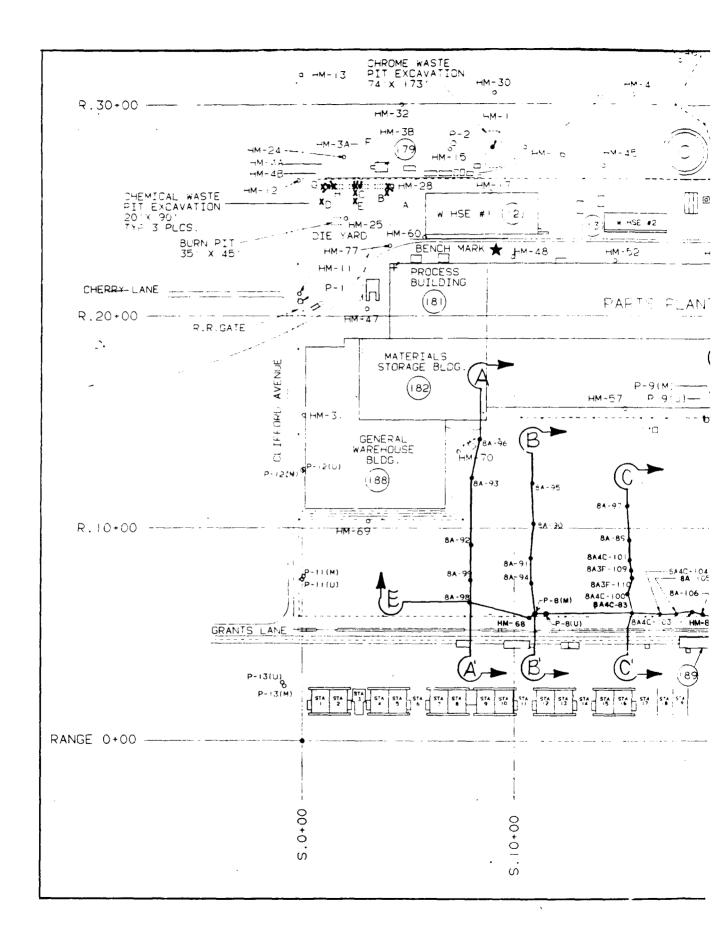
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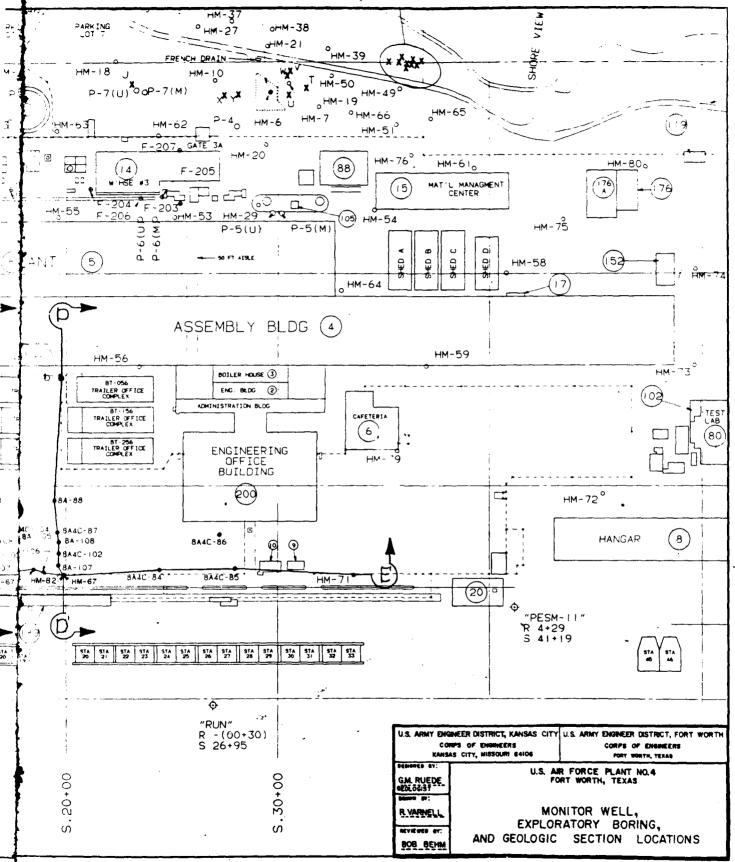
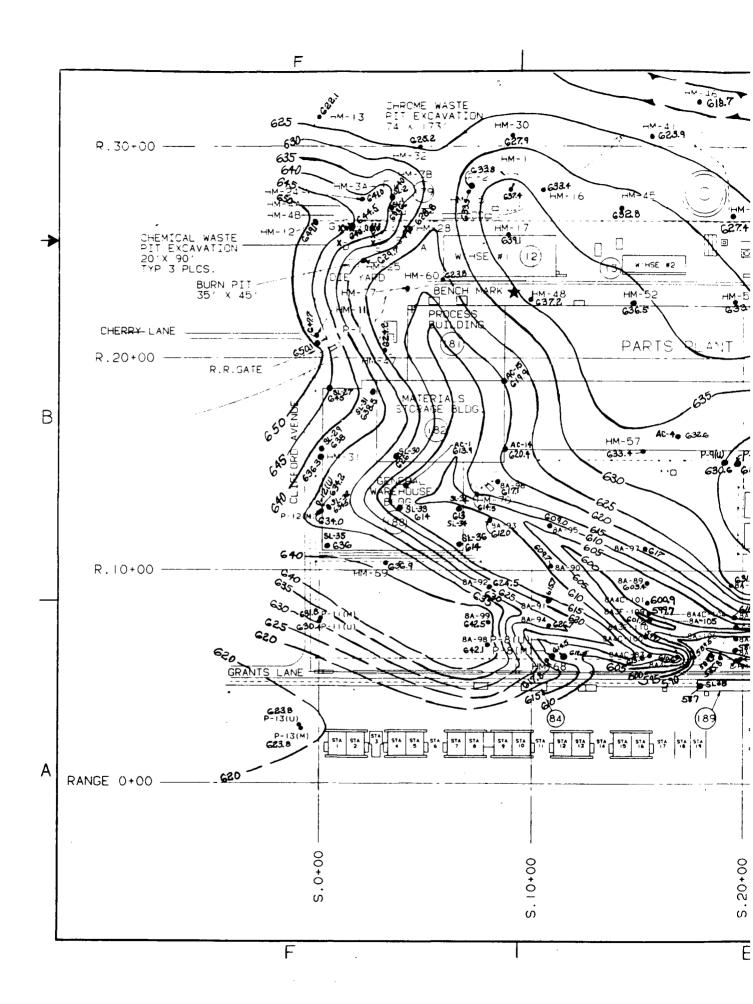
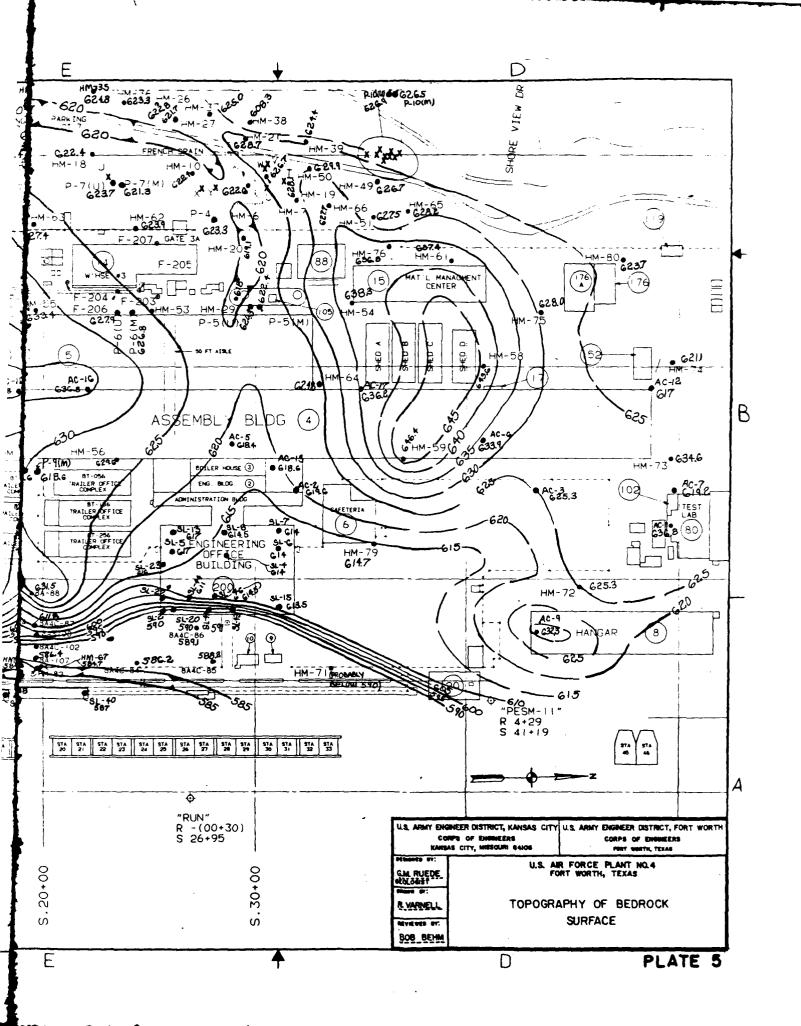
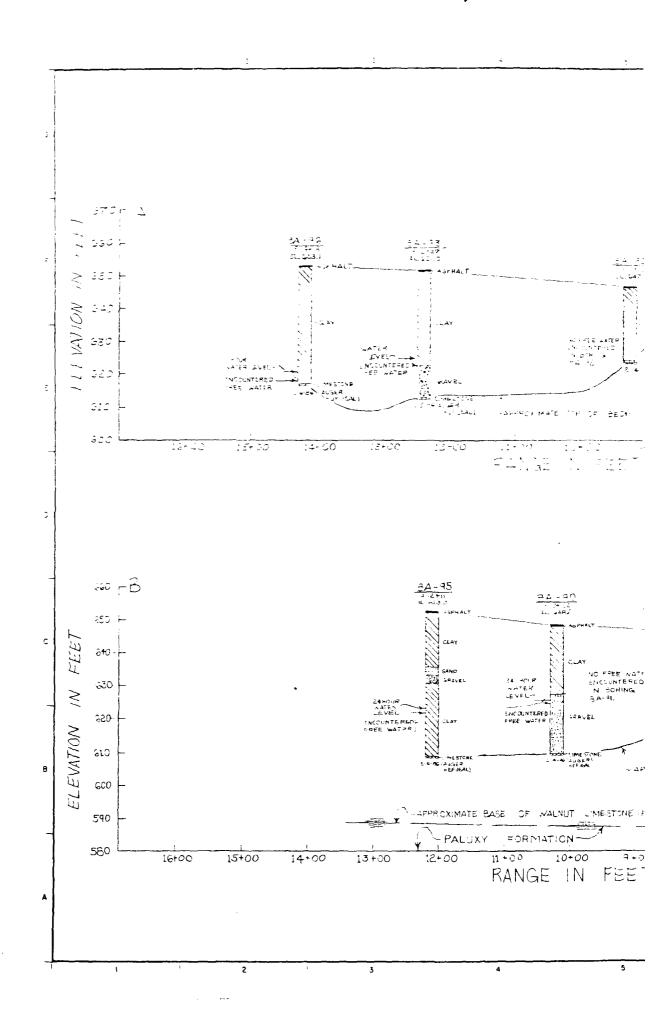
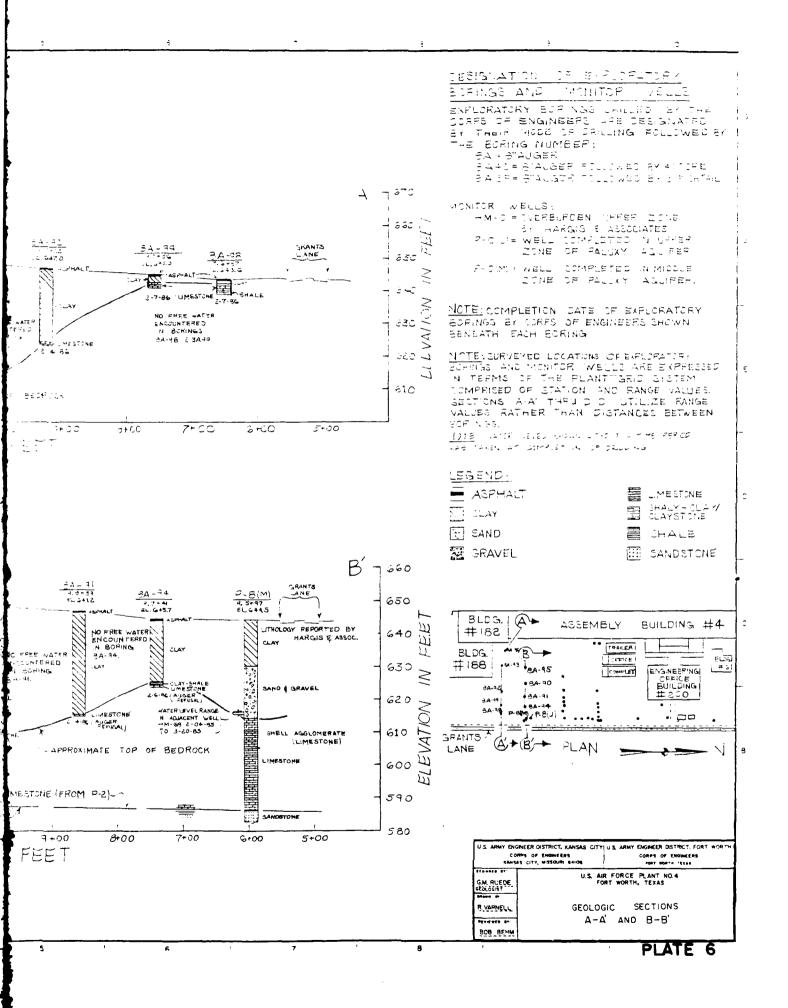


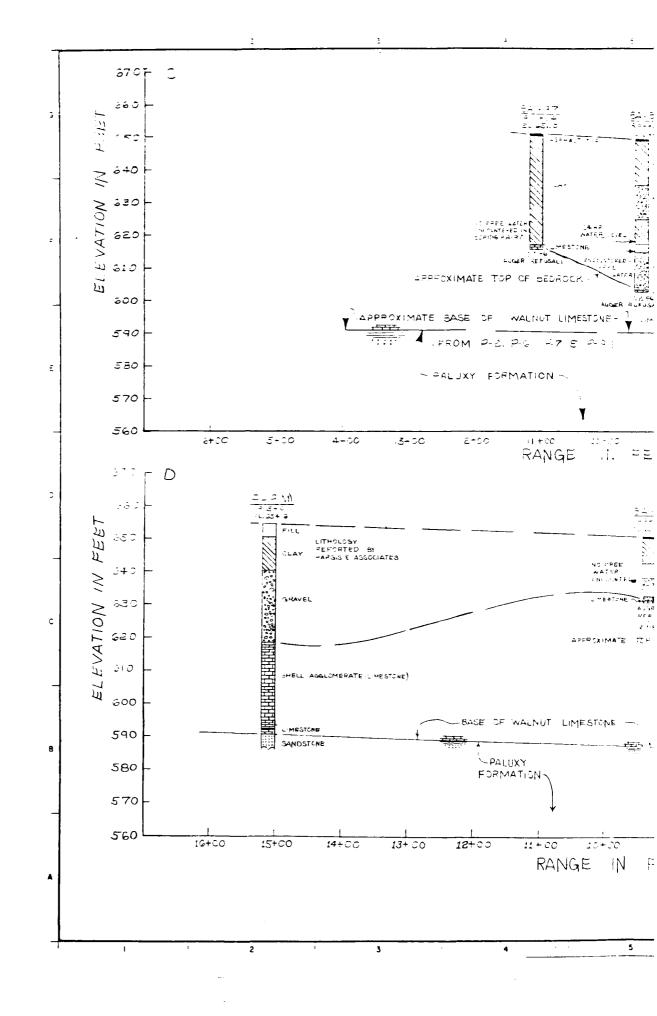
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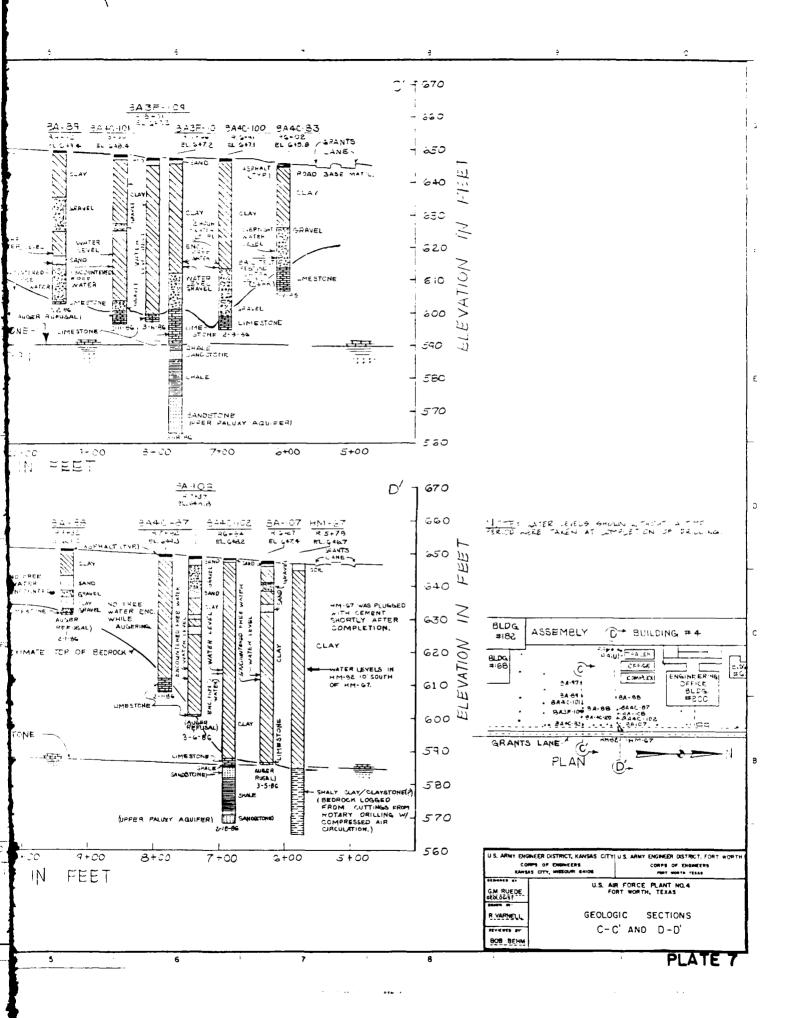


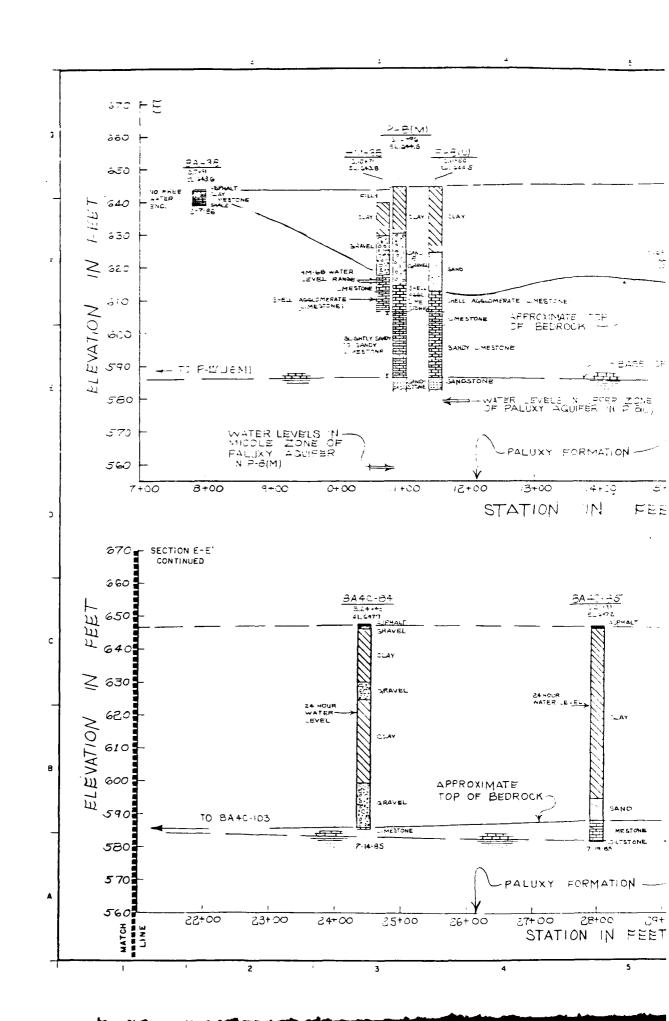


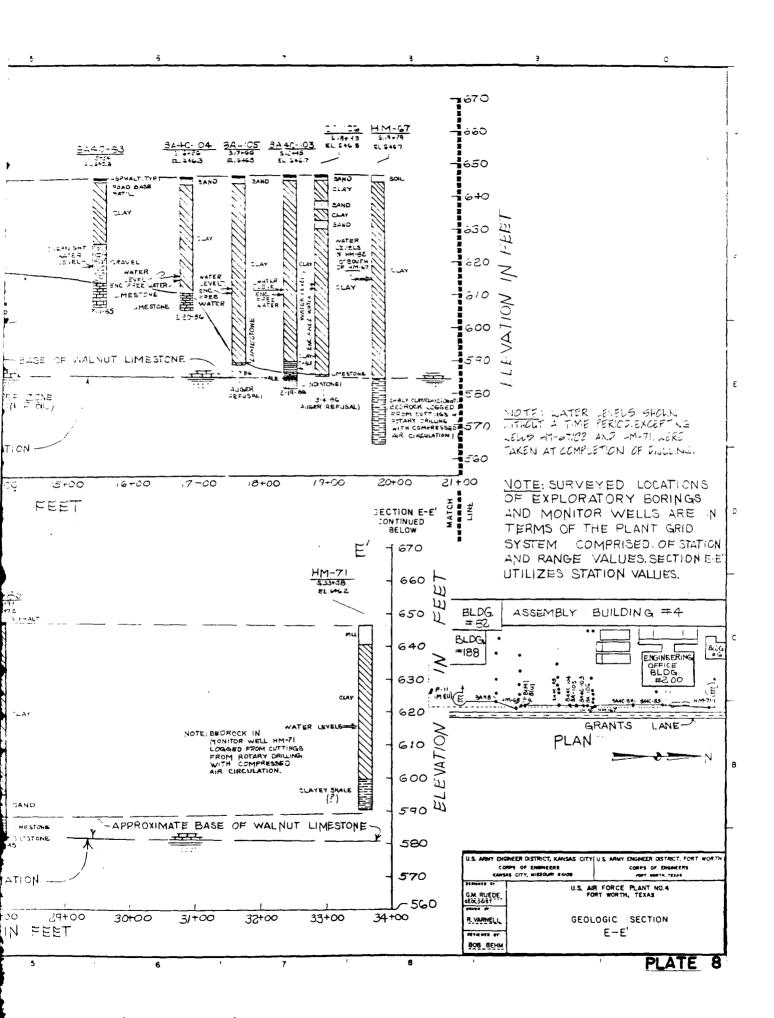












APPENDIX I

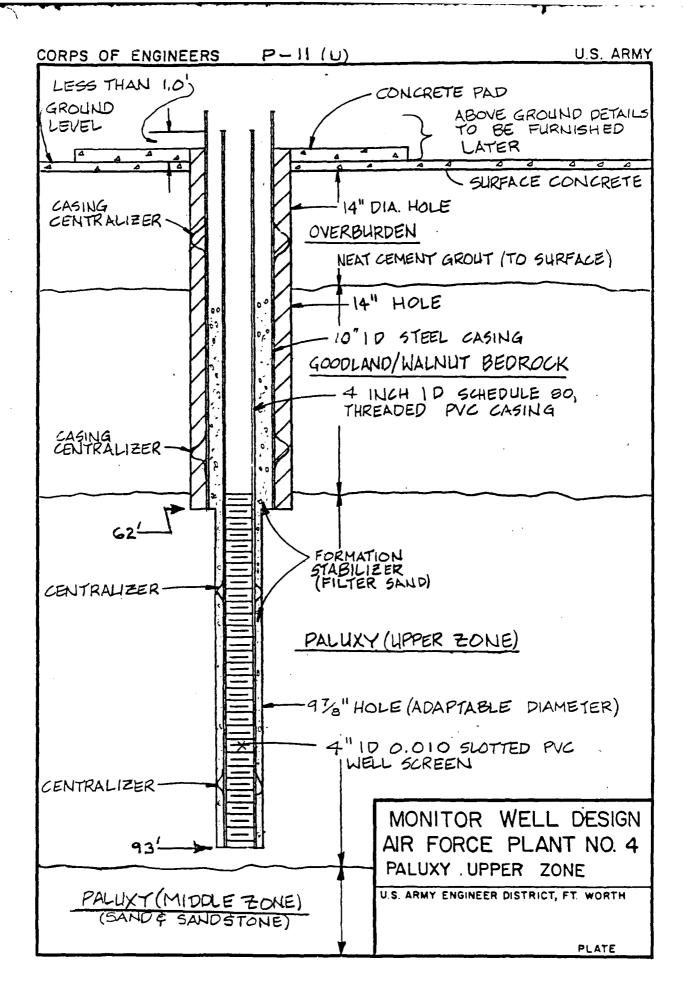
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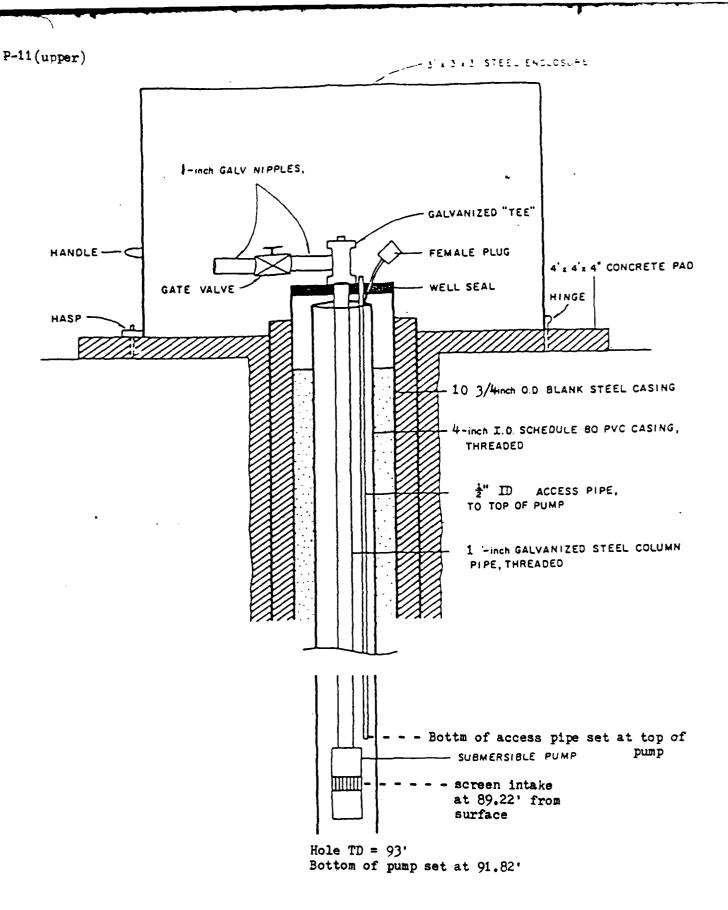
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| smale is as above shale and sand if fine grained, silty, grey, non cemented. Paluxy Fm. Transition zone. 70.1 to 93.0 SAND SANDSTONE - fine, very silty, numerous silt seams, clays with acattered clay/shale seams which generally occur in 0.4 thick or less seams, gray and brown, very soft to moderately hard(rock classification), friable, mostly non cemented, but cement noted from drill action. What is a above shale and sall in the grained, silty, grey, non cemental sone. With intake screen at 89.22'. Joints on pump riser listed from bottom of pump and up to surface; pump length = 0.4', then 21.1', 21.02', 21.12' | 1 | ᆿ | | | İ | | ļ | | | |
| smale is as above shale and sand if fine grained, silty, grey, non cemented. Paluxy Fm. Transition zone. 70.1 to 93.0 SAND SANDSTONE - fine, very silty, numerous silt seams, clays with acattered clay/shale seams which generally occur in 0.4 thick or less seams, gray and brown, very soft to moderately hard(rock classification), friable, mostly non cemented, but cement noted from drill action. What is a above shale and sall in the grained, silty, grey, non cemental sone. With intake screen at 89.22'. Joints on pump riser listed from bottom of pump and up to surface; pump length = 0.4', then 21.1', 21.02', 21.12' | | ⊐ | | SHALE and SAND interb | dded | - | 1 | at total dept | h of 91 | . 22 ' |
| and sand if fine grained, silty, grey, non cemented, Paluxy Fm. Transition zone. 70.1 to 93.0 SAND SANDSTONE - fine, very silty, numerous silt seams, clayey with scattered clay/shale seams which generally occur in 0.4' thick or less seams, gray and brown, very soft to moderately hard(rock classification), friable, mostly non cemented, but cement noted from drill action. 89.22'. Joints on pump riser listed from bottom of pump and up to surface; pump length = 4.4', then 21.1', 21.08', 21.12', 21.12', 21.02', totals = 92.92' with 1' stick up. ALL DEFTHS FR NM SKOUND SURFACE Note: Lithology shown between depths 53.5 and 59.8 feet changed based on reinterpretation of geophyrical log. | 1 | - | | | | | 1 | with intake s | creen'a | t l |
| Joints on pump riser 70.1 to 93.0 SAND SANDSTONE - fine, very silty, numerous silt seams, clayer with acattered clay/shale seams which generally occur in 0.4' thick or less seams, gray and brown, very soft to moderately hard(rock class- ification), friable, moetly non cemented, but cement noted from drill action. Joints on pump riser listed from bottom of pump and up to surface; pump length = 4.4', then 21.1', 21.02', 21.12', 21.12', 4.0' totals = 92.92' with 1' stick up. ALL DEPTHS FRYM SKOUND SDRFACE Note: Lithology shown between dentis 53.5 and 59.8 feet changed based on reinterpre- tation of geophysical log. | 1 | | | | | | ľ | 89.221 | | |
| Joints on pump riser listed from bottom of pump and up to surface: pump length = 4.4°, then 21.1°, 21.0°, 21.12°, 21.12°, 4.0° totals = 92.92° with clayey with acattered clay/shale seams which generally occur in 0.4° thick or less seams, gray and brown, very soft to moderately hard(rock classification), friable, mostly non cemented, but cement noted from drill action. Note: Lithology shown between denths 53.5 and 59.8 feet changed based on reinterpretation of geophysical log. | I | | | | | | Į. | 0,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,, | | 1 |
| SAND SANDSTONE - fine, very | ł | | | | | | 1 | | | 1 |
| pump and up to surface; SAND SANDSTONE - fine, very silty, numerous silt seams, clayey with scattered clay/shale seams which generally occur in 0.4' thick or less seams, gray and brown, very soft to moderately hard(rock class-ification), friable, mostly non cemented, but cement noted from drill action. Define and up to surface; pump length = 4,4', then 21.1', 21.02', 4.0' totals = 92.92' with 1' stick up. ALL Define Friend ALL Define | 1 | _= | | Paluxy Fm. Transition | n zone | • | į. | | | |
| To.1 to 93.0 SAND/SANDSTONE - fine, very silty, numerous silt seams, clayey with acattered clay/shale seams which generally occur in 0.4" thick or less seams, gray and brown, very soft to moderately hard(rock classification), friable, mostly non cemented, but cement noted from drill action. To.1 to 93.0 Dump length = 4.4", then 21.1", 21.02", 4.0" totals = 92.92 with 1 stick up. | | - | | | 1 | | ļ. | listed from | bottom | of |
| To.1 to 93.0 SAND/SANDSTONE - fine, very silty, numerous silt seams, clayey with acattered clay/shale seams which generally occur in 0.4" thick or less seams, gray and brown, very soft to moderately hard(rock classification), friable, mostly non cemented, but cement noted from drill action. To.1 to 93.0 Dump length = 4.4", then 21.1", 21.02", 4.0" totals = 92.92 with 1 stick up. | ŀ | | | | | | 1 | pump and up | to surf | acei |
| SAND SANDSTONE - fine, very silty, numerous silt seams, clayey with acattered clay/shale seams which generally occur in 0.4" thick or less seams, gray and brown, very soft to moderately hard(rock classification), friable, mostly non cemented, but cement noted from drill action. SAND SANDSTONE - fine, very silty, including silty, numerous silt seams, clayed with 12.1.2', 4.0' totals = 92.92' with 1' stick up. ALL DECTHS FROM SROWN SECUND SURFACE Note: Lithology shown between denths 53.5 and 59.8 feet changed based on reinterpretation of geophysical log. | 1 | = | | 70.1 to 93.0 | 1 | | | | | |
| SAND SANDSTONE - fine, very silty, numerous silt seams, clayey with scattered clay/shale seams which generally occur in 0.4' thick or less seams, gray and brown, very soft to moderately hard(rock classification), friable, mostly non cemented, but cessent noted from drill action. 21.12', 21.12', 4.0' totals = 92.92' with 1' stick up. ALL DEFTHS FRIMM SKOUNG SUNFACE Note: Lithology shown between depths 53.5 and 59.8 feet changed based on reinterpretation of geophysical log. | 1 | | | 7,300 | I | | l | | | |
| silty, numerous silt seams, clayey with scattered clay/shale seams which generally occur in 0.4' thick or less seams, gray and brown, very soft to moderately hard(rock classification), friable, mostly non cemented, but cement noted from drill action. Silty, numerous silt seams, clayed with clayed with scattered clayed with it stick up. ALL DEPTHS FRIME SKOUND SUNFACIE Note: Lithology shown between depths 53.5 and 59.8 feet changed based on reinterpretation of geophysical log. | | | | | Į | | I | | | |
| silty, numerous silt seams, clayer with scattered clay/shale seams which generally occur in 0.4" thick or less seams, gray and brown, very soft to moderately hard(rock classification), friable, mostly non cemented, but cement noted from drill action. Skound SDRFACE Note: Lithology shown between depths 53.5 and 59.8 feet changed based on reinterpretation of geophysical log. | j | J | | SAND SANDSTONE - fine | , very | | 1 | | | |
| clayey with scattered clay/shale seams which generally occur in 0.4' thick or less seams, gray and brown, very soft to moderately hard(rock classification), friable, mostly non cemented, but cement noted from drill action. 1' stick up. ALL DEPTHS FROM SROUND SDRFACE Note: Lithology shown between depths 53.5 and 59.8 feet changed based on reinterpretation of geophysical log. | ļ | 7 | | | | | 1 | totals = 92 | .92' wi | th I |
| clay/shale seams which generally occur in 0.4" thick or less seams, gray and brown, very soft to moderately hard(rock classification), friable, mostly non cemented, but cement noted from drill action. Clay/shale seams which generally occur in 0.4" Clay occ | - 1 | | | | | • | 1 | | | í |
| generally occur in 0.4° thick or less seams, gray and brown, very soft to moderately hard(rock classification), friable, mostly non cemented, but cement noted from drill action. Council Service Seams | - 1 | コ | | | | | | · . | - | ŀ |
| thick or less seams, gray and brown, very soft to moderately hard(rock classification), friable, mostly non cemented, but cement noted from drill action. Compared to the c | - 1 | _ | | - | | | | ALL DEP- | THS FE | امدرج |
| and brown, very soft to moderately hard(rock class- ification), friable, mostly non cemented, but cement noted from drill action. Note: Lithology shown between depths 53.5 and 59.8 feet changed based on reinterpre- tation of geophyrical log. | - 1 | _= | 1 | | | | | | | |
| and brown, very soft to moderately hard(rock class-ification), friable, mostly non cemented, but cement noted from drill action. Note: Lithology shown between depths 53.5 and 59.8 feet changed based on reinterpretation of geophyrical log. | - 1 | \neg | i | thick or less seams. | gray | | 1 | | -UK- F1 | _ '= |
| moderately hard(rock class- ification), friable, mostly non cemented, but cement noted from drill action. Note: Lithology shown between depths 53.5 and 59.8 feet changed based on reinterpre- tation of geophyrical log. | ŀ | \dashv | | | | | ļ | | | |
| ification), friable, mostly non cemented, but cement noted from drill action. between denths 53.5 and 59.8 feet changed based on reinterpre- tation of geophyrical log. | i i | ╛ | | | | _ | 1 | Name of the last | | |
| mostly non cemented, but cement noted from drill action. action. and 59.8 feet changed based on reinterpretation of geophyrical log. | - 1 | | j | | CTERN | - | | | | |
| cement noted from drill based on reinterpretation of geophysical log. | 1 | - | | | İ | | | between dep | ths 53. | > |
| cement noted from drill based on reinterpretation of geophysical log. | - 1 | ╛ | | mostly non cemented. | but | |] | and 59.8 fe | et chan | ged l |
| action. tation of geophysical log. | ŀ | ⊐ | | | | | 1 | | | , |
| 10g. | ł | | | | | | | | • | 1 |
| Tunilunilunilunilunilunilunilunilunilunil | 1 | ╛ | | EC 2 70110 | | | | | eobukan | an i |
| | | ョ | | | i | | | log. | | 1 |
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| G FORM 19.1/ | | ュ | | | J | | | | | İ |
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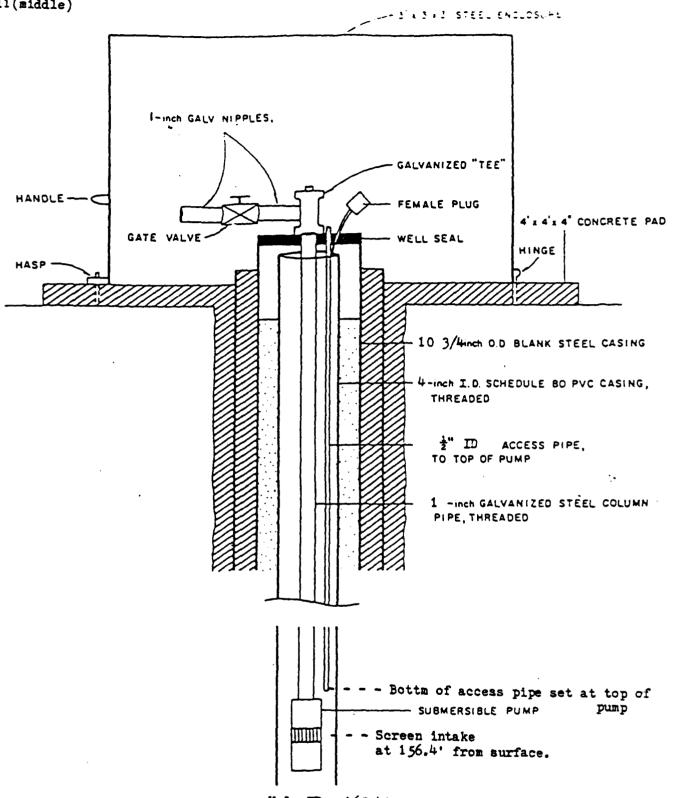


P-11(upper) - Diagram 2 of 2 AF plant #4(GD) - Paluxy Aquifer

| | | | | | | | Hole No. | P-11(=) | _ |
|-------------|----------------|--|---|-------------|----------------|----------|--|----------------|------------------|
| Dett | LINES LC | | SWD | MOTAL | MOTTAL | Ft i | forth | OF 2 SHEETS | |
| I. PROJECT | | (22) | Paluxy Aquifer | 10. SEZE | AHO TYP | OF SIT | | 100 - 200-11 | 1 |
| L. | | _ | | | | | SHOWN (TOWN OF MALE) | | 1 |
| LOCATION | (Constitu | man or It | | | | | SNATION OF BRILL | | 4 |
| I DANK CHIE | AGENCY | | | 12 800 | | iling | | | 1 |
| | | | | 12 TOT | AL NO. OF | | | UMDISTURBED | 1 |
| 4 HOLE NO. | (Aq ato- | | P-11(m) | 9476 | DEK SAMPI | LES TAKE | ** | | 4 |
| E. HAME OF | | | | | AL HUMBE | | | | 4 |
| Brewer | | | | IL ELE | VATION OF | | | | |
| 4. DIRECTIO | | | | N. DAT | E HOLE | 1 | | 6 Aug 85 | 1 |
| ₩ VERT | CAL [] | 1146 L 114 E C | DES. PROM VERT. | | ****** | | G 38, 84 | | ┨ |
| 7. THICKNES | s or ove | ERBURDE | 7.0 | | | | Y FOR SORING | | Η. |
| B. DEPTH DE | HLLED II | ITO ROCI | 1 58.4 | | ATURE OF | | | | H |
| B. TOTAL DE | EPTH OF | HOLE | 165.4_ | | | | 16hert | Mers | |
| ELEVATION | DEPTH | LEGEND | CLASSIFICATION OF MATERIA | u | S CORE | BOX OR | Petting time test | IKS | 1 |
| | | ١. | 1 | | ERY | NO. | (Ording time, rate realizating, etc., | if eignificant | |
| | _ | | 0.0 to 0.3 - Asphalt. | | | | Note: Litholo | gic units | ┲ |
| | = | 1 | 1 | | } | 1 | and their co | | , - |
| | | 1 | 0.3 to 4.8 | | i | 1 | primarily in | | . ⊨ |
| | = | ! | ATIV | | ł . | 1 | from gamma a | na electric | ; E |
| 1 | . = | = | CIAY - high plasticit medium stiff, slight | | ł | | logs. | | E |
|] | 10:- | - 7 | moist, dark brown, c | . • | l | l | * Drilling | | |
| | | - | cal odor at top of u | | Í | i | | | E |
| | _= | | l | • | l | l | 0 to 12.5' - | | |
| (| = | 10 | 4.8 to 7.0 | | | ! | 12.5 to 106' | | ·F |
| | = | | | | 1 | <u> </u> | bit, set 106' | | .F |
| | 20:- | 11// | GRAVEL - coarse to fi | | | İ | metal cang an grouted from | | °⊨ |
| | | 111 | angular, medium dens slightly moist, brow | | 1 | | hole to surfa | | F |
| 1 | = | | very sandy and claye | | } | 1 | 106 to 161.0' | | F |
| | | - 7 | 101, 1111, 1111 011, | , . | | ì | rockbit - t | | \vdash |
| | | | 7.0 to 12.7 | | | | bottom of h | | -E |
| | 30'- | 1/- | | | | i . | ed to be 16 | | E |
| | | 11 | SHALE - weathered to | | · | 1 | driller cla | | E |
| |] = | \perp | plastic and very sti | | | 1 | out of loos | e sand. | E |
| | | ╏┱┸┯ | clay consistency, sl moist, yellow brown | | | | | | F |
| 1 | | 11 | gray, slightly limey | | | | ** | | . = |
| i . | l ∓ | ┸╼┸ | scattered shell frag | | | | | les of fluid | ¹⊨ |
| 1 1 | " " | - 5 - | Walnut Pm. | | | 1 | and cuttings at; 60', 70', | | F |
| | | | | | | | 100 and 10 | | F |
| | | 141 | 12.7 to \$4.0 | | | | A seperate vi | | ᄂ |
| | | 165 | LIMESTONE - weather s | += 1 == | | 1 | fluid and cut | tings taker | ᄟ |
| | _ = | | but mostly white, mo | | • | | at 165'. | | E |
| | 20. — | IV | ataly hard to hard(r | | | | | | Е |
| 1 ! | = | +4 | classification), mod | | | | | | E |
| i I | | | ly to well cemented, | | | ŀ | *** | | F |
| 1 1 | | [: ::::: | oyster shell somes t | | | | Water che | | F |
| ! | . 7 | | out, numerous soft(r | | -) | | thing on morr | | F |
| | 60: | [: : ::::l | shale seams scattere within - they are ge | | l _w | l | hole at 105. | | F |
| | | ┷┷ | less than 1' thick, | | ۲ | | | , Jan 1 | F |
| 1 | = | == | some do thicken up t | 0 | | | Hole bailed t | o 95' on | F |
| l i | | | 2.4', ie especially | | | | 22 Aug 85 wit | | F |
| j (| , ⊐ | | 24.0 to 31.0', unit | | i | | in hole. | | F |
| į i | 70:_ | | very shaley with san | d. | | | Water recover | | L |
| <u> </u> | | | from 54 to 61.5'. Walnut Fm. | | | | within ½ hour | | E |
| 1 | 크 | .;:• | 1 | | | 1 | | | E |
| [| | | 54.0 to 54.8 SHALE | , | | 1 | | | F |
| 1 | ∃ | = = | 54.8 to 61.5 <u>SANDSTON</u> 61.5 to 71.0 | <u> </u> | | 1 | Note: Litholo | gy shown | F |
| | E-08 | ; - ; - | | | | ł | between dept | •- | F |
|]] | ~ ¬ | | SHALE - no apparent w | eath- | | | and 61.5 fee | • | F |
| | 7 | <u> </u> | ering, soft(rx class grey to blue-grey, s | | | | based on rei | • | F |
| | コ | · | seams throughout, si | | | | tation of ge | ophysical | F |
| [[| ⇉ | · | | /• | | l | log. | | F |
| , | a. = | . : : : | | | | l | } | | F |
|] | 90: | - : : . | | | 1 | I | | | F |
|] | ∃ | امهريسنا | | | | | | | E |
| , I | Ξ | : | | | | l | | | E |
| | \exists | <u> -</u> ; | | | | 1 | | | F |
| [| 7 | - <u>-</u> - | | | | 1 | | | F |
| ENG FORM | 444- | · · | <u> </u> | | PROJECT | L | | HOLE NO. | ᅩ |
| MAR 71 | 1836 | PREVIOL | IS EDITIONS ARE OBSOLETE. | | | | | | |

Hole No. P-11 (m)

| | | | | THE TALL | | | Hole No. | | | | |
|------------|------------------|--------------|---|-----------|-------------|-------------------|--|----------|----------------|--|--|
| Desti | LING LO | | SWD | | Ft We | orth | | or 2 | 2 | | |
| PROJECT | | (CD) | Paluxy Aquifer | | AND TYPE | | 4 | | | | |
| LOCATION | Ant #4 | ·(GD) | Haluxy Aquifer | 11. BATU | e POR EL | EVATION. | SHOWN (THE COME) | | | | |
| | | | | 12. HANG | PACTURE | IPT DESK | BHATION OF BRILL | | - | | |
| . DANLLING | AGENCY | | | 12 7074 | . ** | OVER | DISTURBED | Une De S | TURBED | | |
| HOLE NO. | (Ag about | - | P-11(m) | SURE | DI SAMA | OYER- LES YAKE | ING . | | | | |
| . HAME OF | DRILLER | | : • - • () | | | R CORE | | | | | |
| | | | | IL ELEV | ATION OF | NOUND WA | | LET | | | |
| DIRECTIO | | | 054. FROM VERT. | IG. DATE | HOLE | | | | | | |
| . THICKNES | | | | 17. ELEV | ATION TO | P OF HO | LE | | | | |
| DEPTH OF | | | | | | | Y FOR SORIHE | | | | |
| L TOTAL DE | EPTH OF | HOLE | 165.4* | 10. SIGN. | TURE OF | HEPECT | Crest McVer | | | | |
| ELEVATION | DEPTH | LEGENO | CLAMIFICATION OF MATERIA | | S CORE | SOX OR SAMPLE | (Drilling time, water | K\$ | | | |
| • | _ | • | _ (| | | MQ. | | il signi | - | | |
| | | | 71.0 to 153.3 | | | | Instrume | mtst: | lon | | |
| | | | 71.0 00 199.9 | | | 1 | III CI UI | | 1011 | | |
| | = | | SAND/SANDSTONE - no a | | t | | Set 4" pvc I | | | | |
| | = | · | weathering, friable, ly to non cemented, | | | | and gravel pa | cked | up to | | |
| | 110 | · = - | to moderately hard(r | | | | The 4" pvc jo | ints | were | | |
| | l ∃ | | classification), fin | • | | | recorded from | the | | | |
| | \exists | | grained, very silty, a few thin lime stri | | | | up as follows plug and bl | | . + | | |
| | ╡ | ٠ | scattered, clay/shall | | | | bottom(165.4 | | | | |
| | ا ا | | throughout and usual | ly | | | joints at .6 | , 4. | .75'. | | |
| | ' <i>&</i> - | \cdots | are less than 1' thi pyrite concretions s | | | | the screens at 19.77', th | | | | |
| | ∃ | | tered, lignite noted | | | [] | joints at 9.7 | | | | |
| | \exists | ٠. ١ | 82', | 1 | | | 9.78', 9.79' | 9.7 | 5. | | |
| | | | harder somes noted a 123.5 to 124.7', and | | | | 9.78 9.76 | 9. | 76', | | |
| . 1 | 130:- | | 128.3 to 129.0'. | ł | | | 9.71'.9.78'. 9.79'. 9.79' | 3 · (| 74 | | |
| | | ا ـ ـ ا | thicker shale/clay s | | | | 4.77' which | | | | |
| | \exists | | or very shaley somes | noted | | | 1.3' stick | | | | |
| | 3 | | at; 77.3 to 79.5', | l | | | with stabil! them are inc | | | | |
| i | ∃ | | 83.8 to 86.1, | 1 | | i | underlining | | | | |
| - 1 | / /// | <u>'</u> | 92.5 to 94', | Į. | | | above - all | | | | |
| | コ | | 96.0 to 99", 104 to 109.8", 127. | 2 to | | | are 5' below | / S& 1 | d Joi n | | |
| | \exists | | 129', 132.8 to 135', 14 | 0.0 td | | | Sad subsessed | 12.1. | | | |
| ľ | '∃ | : • : : | 142.2', 144.3 to 145'. | Paluxy | <u>Fa</u> . | | Set submers: (Standard,1/2 | | | | |
| | 150 | | | l | | | at 110') do | own t | 0 159' | | |
| | ~ | : : : | 153.3 to 165.4 | } | | | with intake | | | | |
| | = | ا+ ب | GAMES A CHARES A A S | | | | above bottom this is followed | | | | |
| 1 | \exists | ; | SAND and SHALE interb sand is fine, friabl | | | | sections of | | | | |
| i | Ε | ·±: | silty, the shale is | | | | pipe all of | | | | |
|) | 160- | 1 | grey, both are soft(| xx | | ; | a 21,2' leng | | | | |
| | Ⅎ | ·÷: - | class), | ŀ | | | section of | | | | |
| j | 165:- | | | j | | | at top incl | | | | |
| | · = | | | ĺ | | | stick up. | | | | |
| | 月 | 1 | | 1 | | | For further | det | ile o | | |
| ĺ | \exists | 1 | | İ | | | installation | | | | |
| | Ε | | | l | | | diagram. | | | | |
| i | 긬 | ł | | - 1 | | | ALL DEPT | HS 1 | -ROM | | |
| | コ | | | Ì | | | GROUND | | | | |
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| | | | | | | | | | | | |



Hole TD = 165.4Bottom of pump set at 159'.

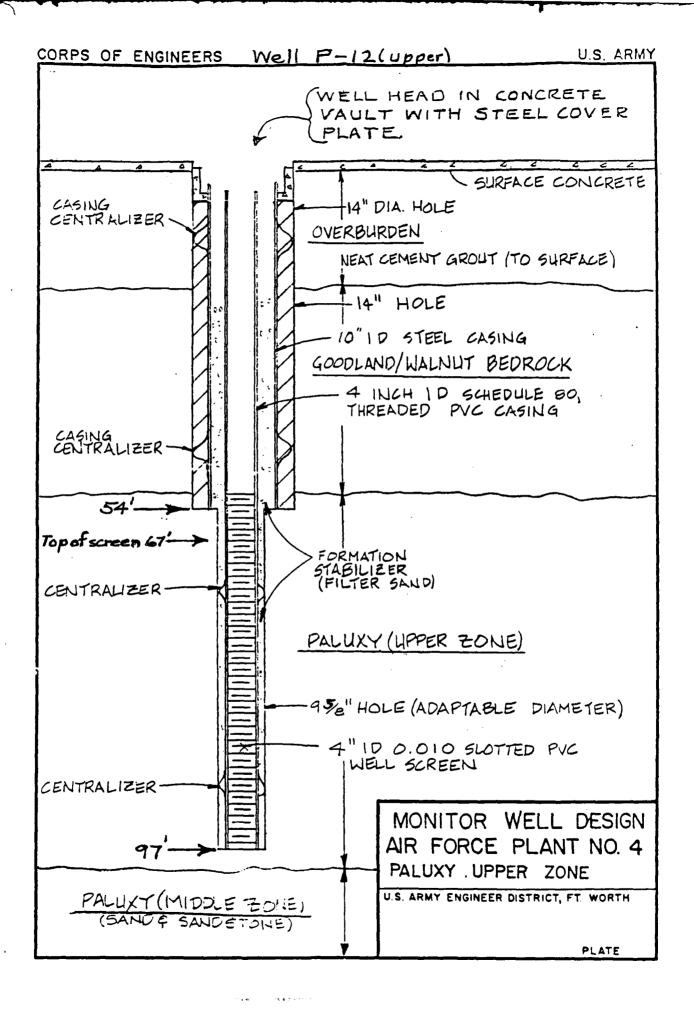
P-11(middle) - Diagram 2 of 2 AF Plant #4(GD) - Paluxy Aquifer

P-12(u) DRILLING LOG Ft Worth SWD .F. Plant #4(GD), Paluxy Aquifer LAZATON /C. 12. MANUPACTURER'S DESIGNATION OF BRILL DAN LINE AGENCY Failing 1500 USCE 12 TOTAL HO. OF OVER-HOLE NO. (As at P-12(u) 14. TOTAL NUMBER CORE BOXES NAME OF BRILLIA IL ELEVATION CROWNS WATER Brewer 16 Sept 85 24 Sept 85 M. DATE HOLE WALLINED ---17. ELEVATION TOP OF HOLE 643.64 7. THICKNESS OF OVERBURDEN 16. TOTAL CORE RECOVERY FO DEPTH DRILLED HITO ROCK 87.6 TOTAL DEPTH OF HOLE 97' CLASSIFICATION OF MATERIALS HECOV-LEGEN 0.0 to 0.5 - Concrete. Note: Lithologic units 0.5 to 1.0 - Base GRAVEL. and their contacts wre primarily interpreted 1.0 to 3.3 by project geologist from gamma and electric CLAY - high plasticity, logs. stiff, slightly moist, dark brown, slightly sandy * Drilling 3.3 to 8.7 0 to 0.5' - 14" rockbit, 0.5 to 10.5' - 14" auger, 10.5 to 97' - 14" rock-GRAVEL and SAND interbedded both are coarse to fine, bit, medium dense, slightly set 52' of 10" metal moist, dark brown to white casing after 54' attainclayey and combles up to ed. The casing was then 6", calcareous. grouted in from the bottom and up to surface 8.7 to 9.4 CLAY - high plasticity, Vial samples were stiff to very stiff, taken at the following slightly moist, yellow depths: brown, lime nodules, cyste at 4' - auger cutshells, sandy and gravelly possibly a reworked shale. at 97' - rockbit cuttings in one vial and drill fluid in another. 9.4 to 54.6 LIMESTONE - weather stains, white with yellow brown. dole bailed after moderately hard to hard completion of drilling. (rock classification), Water level taken after moderately to well cementinstallation of 4" pipe ed, soft(rx class) shale at 87.9'. seams scattered throughout, oyster beds within. Very shaley some from 15.9 to 25.5'. Installation 54.6 to 55.2 SHALE 55.2 to 59.0 SANDSTONE Set 4" pvc pipe to TD of 97' with screen fi with screen from 59.0 to 72.8 97 to 67'(plug in bot-SHALE and SAND interbedded tom) and blanks to sand is fine grained and surface with 1' stick friable, shale is an unweathered dark gray, No pump installed. both are soft(rx class). Pipe to be set inder ground at a later date. Pump for sampling installed later. ALL DEPTHS FROM GROUND SURFACE

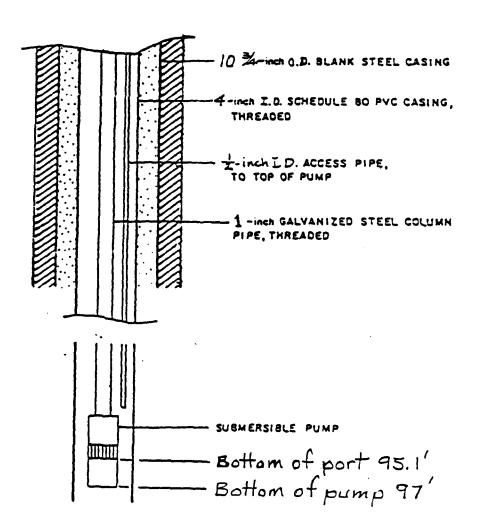
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M-1-M- P-12(u)

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| | | | SAND/SANDSTONE - fine | grain | | | | depths 54.6 | | |
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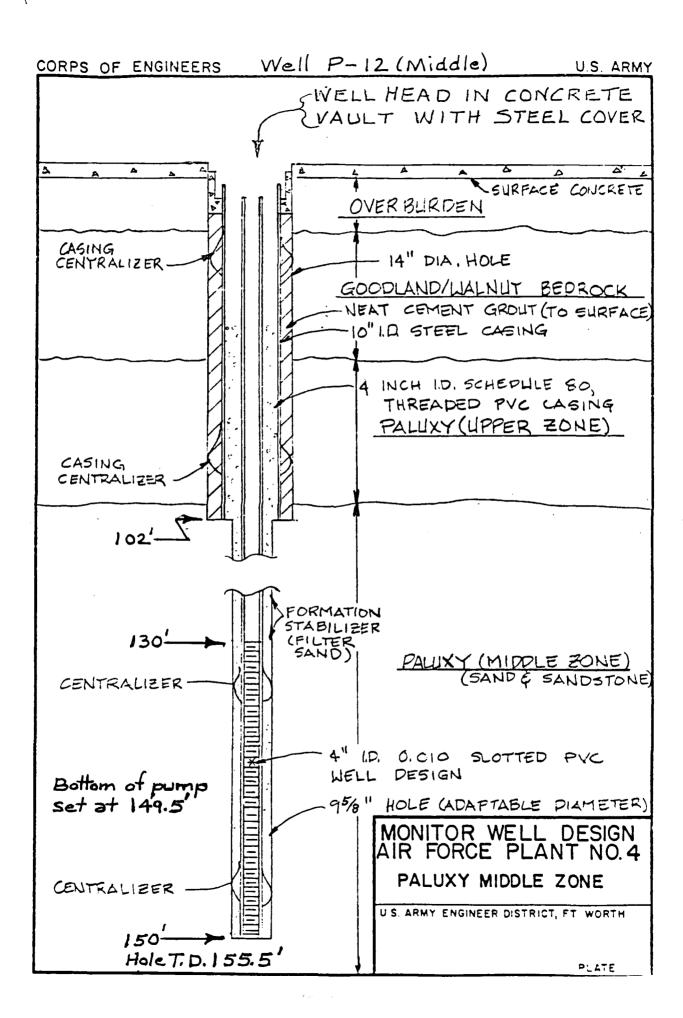
WELL P-12 (U)



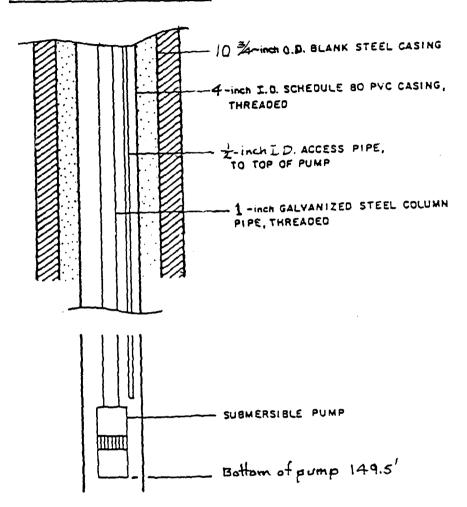
Note No. P-12(M) W 7 7 00 2 SHEETS DEILLING LOG Pt Worth SWN M. MIE MID TYPE OF BIT .F. Plant #4(GD), Paluxy Aquifer LATER TO THE RESIDENCE OF THE PARTY OF THE P IL MANUFACTURER'S DEMONATION OF CRILL SCE ASENCY Failing 1500 13. TOTAL NO. OF OVER-HOLE NO. (As shown an absented title P-12(M) 14. TOTAL NUMBER CORE BOXES HAME OF BOILE IL ELEVATION GROUND WATER Brever 16 Sept 85 3 Sept 85 M. DATE HOLE TVERTICAL CHELINES 17. ELEVATION TOP OF HOLE 643,54 9.4 THICKNESS OF OVERSUSDEN 18. TOTAL CORE RECOVERY FOR SORING 18. TOTAL CORE RECTOR DEPTH DRILLED WITG SOCK 146.1 McVe TOTAL DEPTH OF HOLE 155.5 CLASSIFICATION OF MATERIALS LEVATION DEPTH LEGENG 0.0 to 0.5 - Concrete. Note: Lithologic inter-0.5 to 1.0 - Base GRAVEL. pretation and their contacts were determined 1.0 to 3.5 by the project geologist primarily from CLAY - high plasticity, gamma and electric logs stiff, slightly moist, 14.64 dark gray to dark brown, · Drilling 3 1) 6 sandy and gravelly, calcardous. 罪 0 to 0.5' - 14" rockbit. 0.5 to 10.5' - 14" auger. 日子日3.5 to 8.7 10.5 to 155.5' - rock-177 bit, SAND and GRAVEL interbedded met 103' of 10" metal both are coarse to fine pipe of which one foot grained, medium dense, was stick up. slightly moist, dark brown The cang was then groutclayey, cobbles, calcareous, ed up from the bottom to the surface. 8.7 to 9.5 Installations CLAY - high plasticity, stiff to very stiff, slight Set 4" pvc pipe to TD ly moist, yellow brown. with intake screen from lime nodules and concent-T) 150 to 130'. This pipe rations, sandy and gravelly, was then graveled up to possibly a reworked shale. 77'. The bottom of pump was then set at 149.5' 40 and 1" riser pipe to surface with 1' stickup. 9.5 to 54.4 LIMESTONE - weather stains All pump and pipe system throughout, white and yelto be set under ground low brown stains, moderately at a later date. hard to very hard(rock class Diagram to be completed ification), moderately to when above system comwell comented, oyster leted. shells throughout with dense oyster beds within, shale seams scattered throughout as are lignite Hole bailed after comseams, a very shaley some pletion of drilling. is encountered from 10.9 Water check on 17 Sept to 15.8', the shale is 1985 at 87.9'. soft(rock classification). 54.4 to 55.0 SHALE 55.0 to 58.8 SANDSTONE Vial samples taken at: one from aug-58.8 to 72.6 er cuttings SHALE and SAND interbedded one from drill fluid sand is fine grained and friable, shale is essentially rockbit cuttings at unweathered dark grey, 155.5'. both are soft(rx class) ALL. DEPTHS FROM GROUND SURFACE with lignite seams and lime stringers within.

MOLE NO.

P-12(M) Ft Worth DRILLING LOG SWD OF 2 SHEETS 10. SIZE AND TYPE OF DIT A.F. Plant #4(GD), Paluxy Aquifer 12. MANUFACTURER'S DESIGNATION OF ORILL USCE 13. TOTAL NO. OF OVER-HOLE HO. (As P-12(M) 14. TOTAL HUMBER CORE BOXES IS ELEVATION GROUND WATER DIRECTION OF HOLE 16. DATE HOLE TYERTICAL THELINED 17. ELEVATION TOP OF HOLE . THICKNESS OF OVERSURDEN 16. TOTAL CORE RECOVERY FOR SOR DEPTH ORILLED INTO ROCK 19. SIGNATURE OF INSPECTOR Mever 155.5 TOTAL DEPTH OF HOLE # COME CLASSIFICATION OF MATERIALS ELEVATION DESTM LEGENG 72.6 to 155.5 Note: Lithology shown between depths 54.4 SAND/SANDSTONE - Paluxy Fm. and 65.8 feet changed fine grained, no apparent weathering, friable, non based on reinterpretation of geophysical cemented to weakly cementlog. ed from top of unit to 115.5', then cementation tends to increase in hardness and frequency of appearance, light grey, some white, lime stringers scattered, shale seams and sones scattered throughout ie, 100.5 to 102', 114.2 to 115.5', 145.4 to 148', and 153.1 to 154.3', this unit overall varies from soft to moderately hard(rock classification). ENG FORM 1836 PREVIOUS EDITIONS ARE DESOLETE.



WELL P-12(M)



Hele No. P-13(u) METALLATION MEET DRILLING LOG OF 3 SHEETS Ft Worth PROJECT 10. SIZE AND TYPE OF BIT # Air Force Plant #4 Paluxy Aquifer 12. MANUFACTURER'S DESIGNATION OF DRILL Failing 1500 USCE HOLE HO. (As also use an drawing state) 13. TOTAL NO. OF OVER-0 P-13(u) 14 TOTAL NUMBER CORE BOXES A MAME OF DRILLE IL ELEVATION GROUND WATER S. DIRECTION OF HOLE 7 Jan 86 30 Jan 86 VERTICAL MINCLINED DES. FROM VERT 17. ELEVATION TOP OF HOLE 638./8 7. THICKNESS OF OVERBURDEN 14.4 IB. TOTAL CORE RECOVERY FOR BORIS . DEPTH DRILLED INTO ROCK 76.1 19. SIGNATURE OF INSPECTOR D TOMES BOX OF SAMPLE Musli TOTAL DEPTH OF HOLE 90.5 CLASSIFICATION OF MATERIALS REMARKS ELEVATION DEPTH LEGEND (Drilling time, mater lose, depth of meetiering, etc., if eignificant i* Drilling 0.0 to 6.9 CIAY - fill, medium plasti-city, moderately stiff, 0.0 to 14.5' - 10" auger, 14.5 to 68.0' - 12" pilot bit & 14" rockbit. 68 to 90.5' - 10" rockslightly moist, black to brown, scattered gravels. bit. 6.9 to 8.9 2. Bedrock lithologies CLAY - medium plasticity, identified from drill moderately stiff, slight-ly moist, black/brown, cuttings, rate of bit penetration, and from scattered gravels. electric log. 8.9 to 14.4 3. Casing: 10" steel casing set to 68' with cement cir-GRAVEL - slightly cobbly, clayey, slightly moist. culated to the ground surface. 4" pvc, 0.010 slot 14.4 to 26.0 screen set 90.1' to 70.1'. SHALE - calcareous. 4" pvc schedule 80 csg set from 70.1 to surface 26.0 to 28.3 . <u>Pump:</u> 2 7/8" dia, 20 stage, LIMESTONE - shaly. 20 single phase, model 2x4 P050, 8gpm(max) 28.3 to 55.3 pump, made by Standard Pump Co., Bartlesville, LIMESTONE - few shale Ok. Pump suction at seams except from 42.0 to 88.1' below ground 47.5' where shaly. surface.

PROJECT

HOLE NO

ENG FORM 18 36 PREVIOUS EDITIONS ARE OBSOLETE.

Hole No. P-13(u) INSTALLATION MEET DRILLING LOG SWD Ft Worth OF 3 SHEETS OUT COL 16. SIZE AND TYPE OF SIT Air Force Plant #4. Paluxy Aquifer LOCATION (Countinates or Station) 12. MANUFACTURER'S DESIGNATION OF DRILL 1 DRILLING AGENCY 12. TOTAL NO. OF OVER-HOLE NO. (As shows on drawing title P-13(u) 14. TOTAL NUMBER CORE BOXES L HAME OF DRILLER IL ELEVATION GROUND WATER L DIRECTION OF HOLE 16. DATE HOLE - VERTICAL - INCLINED DES. FROM VERT 17. ELEVATION TOP OF HOLE 7. THICKNESS OF OVERBURDEN 16. TOTAL CORE RECOVERY FOR B DEPTH ORILLED INTO ROCK TOTAL DEPTH OF HOLE 90.5 ames) PERY BOX OF SAMPLE REMARKS no, mater loss, depth of G. ofc., if eignificant CLASSIFICATION OF MATERIALS ELEVATION LEGENO 55.3 to 56.0 SHALE -56.0 to 63.7 SANDSTONE - silty. 63.7 to 72.0 SHALE. 50 72.0 to 76.0 SANDSTONE - very silty decreasing with depth to slightly silty. 76.0 to 90.5 SANDSTONE - contains a number of shale streaks and thin seams. - T.D. 90.5' -HOLE NO.

PROJECT

Hole No. P-13(u) SHEET 3 HSTALLATION DRILLING LOG SWD Ft Worth MOJECT M. SIZE AND TYPE OF BIT Air Force Plant #4, Paluxy Aquifer 12. MANUFACTURER'S DESIGNATION OF ORILL HOLE NO. (As shown an drawing title 19. TOTAL NO. OF OVER-P-13(u) 14. TOTAL NUMBER CORE BOXES MAME OF DOLL FO IL ELEVATION GROUND WATER L DIRECTION OF HOLE 16. DATE HOLE TVERTICAL TINCLINED 17. ELEVATION TOP OF HOLE 7. THICKHESS OF OVERSURDEN 18. TOTAL CORE RECOVERY FOR SC B. DEPTH DRILLED INTO ROCK ATURE OF INSPECTOR S/COME BOX CO TOTAL DEPTH OF HOLE 90,5 REMARKS CLASSIFICATION OF MATERIALS ELEVATION LEGENO DEPTH 90

PROJECT

PLATE

Paluxy Monitor Well P-13(U)

STALL AND ST OF SHEETS DRILLING LOG Fort Worth :WD 10. SIZE AND TYPE OF SIT 14" Reamer Air Force Plant Number 4 LOCATION /C. Paiuxy Aquifer Follution Investigation 12 MANUFACTURER'S DEMENATION OF GAILL
ORILLING ASSENCY
Pailing 1500 Failing 1500 USCEC 13. TOTAL NO. OF OVER-HOLE NO. (As about as de P 1 4 - M 14. TOTAL NUMBER CORE BOXES HAME OF DRILLER IL ELEVATION GROUND WATER See comment 1 Brewer -COMPLETED A DIRECTION OF WOLF IS. DATE HOLE 16 Dec. 35 DEG. PROM VER X VERTICAL INCLINED 637.83 17. ELEVATION TOP OF HOLE 7. THICKNESS OF OVERBURDEN 14.0 18. TOTAL CORE RECOVERY FOR BO DEPTH DRILLED INTO ROCK MATURE OF INSPECTOR S. TOTAL DEPTH OF HOLE PÉMARKS CLAMIFICATION OF MATERIALS ELEVATION DEPTH LEGEND ete. II ele Water Level 0.0' to 5.5' No water level was CLAY FILL: black-brown; taken prior to the medium plasticity; medium grouting of the casing. stiff; slightly moist; scattered gravel. 5.5' to 8.5' CLAY: plack-brown; Drilling Methods medium plasticity; medium 0.0 - 14.5stiff; slightly moist; auger. scattered gravel. 14.5 - 56.0 - reamer (11" rockbit with a 14 8.5° to 14.0° expander). GRAVEL: some cobbles; 56.0 - 77.0 - 10" clayey; slightly moist. rockbit. 77.0 - 100.0 - 6" 14.0' to 26.0' core barrel. SHALE: Reamed the hole to 100° calcareous. Identified with the reamer. by cuttings, rate of bit 100.0 - 110.0 - reame Electric logged the hol penetration, and electric Placed 103' of steel log only. casing. 26.0' to 28.0' Grouted the casing in LIMESTONE: place. Drilled the Front out Shaly. Identified by of the casing. 20 cuttings, rate of bit From 14.0° to 77.0° penetration, and electri the lithic descriptions log only. are generally based 28.0' to 55.5' upon electric log interpretations. LIMESTONE: occassional shale seams. Identified by cuttings, rate of bit penetration, and electric log only.

Hole No. P 12 - M

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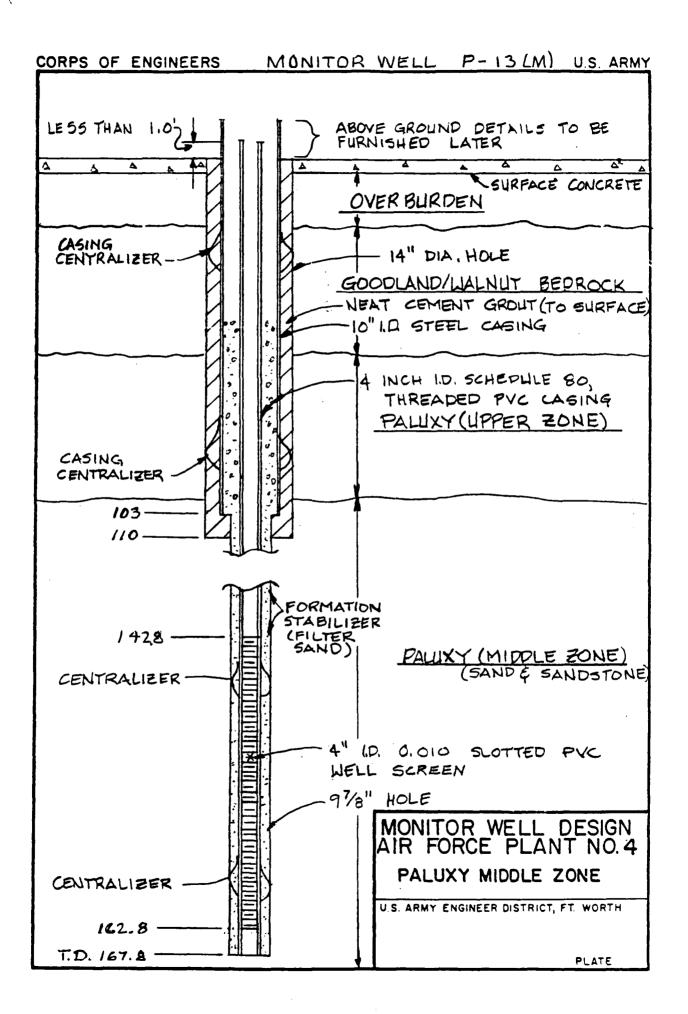
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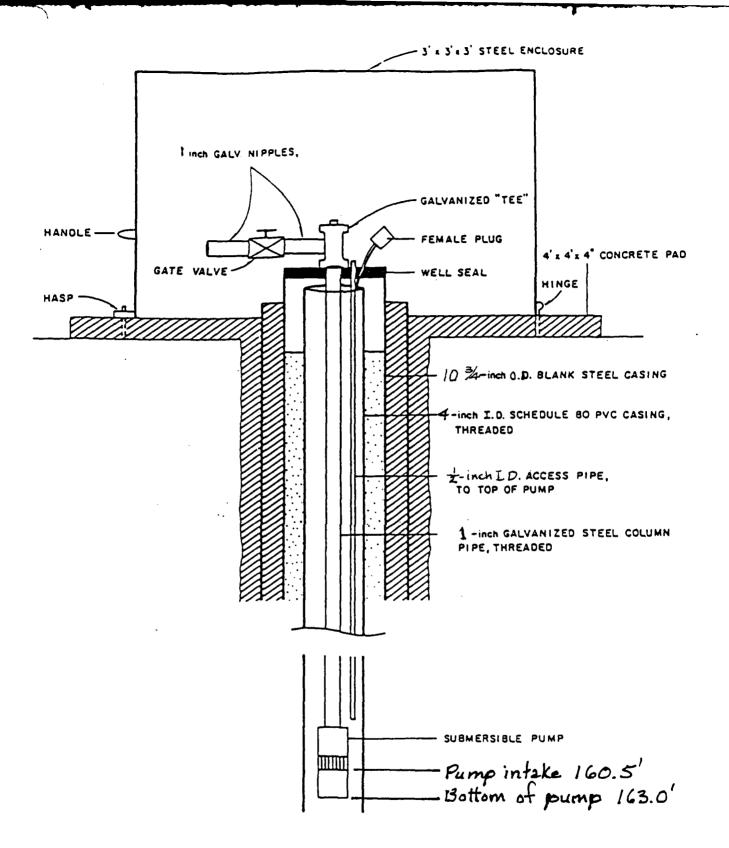
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| Dett | LING LO | 6 | SMD PANISTON | HISTALL | | Fort Wo | - | SHEET OF 3 | SHEETS | |
| PROJECT | | | | 10. 227 | | | 4" Reamer, | | | |
| | Ai | r Por | ce Plant Number 4 | TT. DAY | N FOR E | EVATION | MOUN (750 a | TOTAL S | | |
| LOCATION | i (Coardin | mon or S | (ation) | → · · · · · · · · · · · · · · · · · · · | | | | | | |
| Palu | xy Acu | ifer | Pollution Investigation | 12 MAN | PACTURE | | | iLL | | |
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| NAME OF | DRILLER | | Brewer | 18 51 | ATION 64 | HOUMD WA | TER See co | 4 | | |
| DIRECTIO | # 05 HOL | | DEGMOT | T | | ISTA | ATED | | | |
| Y VERTI | | | D DEG. PROM VERT. | M. DAT | E HOLE | | Dec. 85 | 3 Jan 8 | | |
| | | | | 17. ELE | VATION TO | | | - L HAIL- B | <u></u> | |
| THICKNES | 5 OF OVE | ROURD | EN 14.0 | 10 TOT | AL CORE | ECOVER | FOR BORING | 65.0 | - | |
| DEPTH DE | HLLED IN | TO ROC | * | | ATURE OF | | 00 / | .7 / | 1 | |
| TOTAL DE | EPTH OF | HOLE | | | | | Rando | 124/4 | chr 2 | |
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| | = | - | 94.2-94.5 - a few | | L-1.2 | , | | | | |
| | | | coarse sand layers | lip- | | ' | | | | |
| | | ::::: | ping at 20°. | | 84.0 | | | | | |
| | - | | 94.6-94.8 - inter | pedded | AUN 3 | 84.8 | | | | |
| | 7 | | . clay and sand. | | | 8 | | | | |
| | | | 95.2-95.3 - a few | 11g- | 1 | 0 | | | | |
| | ∣ ⊒ | | nitic laminae. | | L - 0,0 | X | | | | |
| | | • • • | 96.0' to 110.0': so | oft- | | " | | | | |
| | | | moderately hard; coa | | 88.0 | 12 | | | | |
| | コ | . • . • | grained. | | RUN 4 | 89.2 | | | | |
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| ľ | | | Below 100.0' the san | d was | L-a2 | 9 | | | | |
| | コ | | identified by cutting | g 3 , | 92.0 | X | | | | |
| | \dashv | :::: | rate of bit penetrat | , | Run 5 | _ | | | | |
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| ſ | ョ | | .] | | L-1.2 | 94.7 | , | | | |
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Hole No. P-13(m) ext. ALL VIEW of 2 SHEETS DRILLING LOS SYD Ft Worth au/e M. MEE AND TYPE OF SIT Paluxy Aquifer Pollution Investigation diameter or Station Eir Force plant #4. 2. HANUFACTURER'S DESIGNATION OF DRILL USCE Failing 1500 12. TOTAL NO. OF SHOP OLE HO. (As al P-13(m)exstension SER CORE BOXES HAME OF DRILLER IL ELEVATION GROUND WATER To be determined Brewer/Merva ST ART EG DIRECTION OF HOLE 25 July 86 21 July 86 VERTICAL MINCLINED 17. ELEVATION TOP OF HOLE G37.83 . THICKNESS OF OVERBURDEN 14. 16. TOTAL CORE RECOVERY FOR SORIHE DEPTH DRILLED INTO ROCK 153,8 18. BIGHATURE OF INSPECTED MVey S. TOTAL DEPTH OF HOLE 167.8 CLASHFICATION OF NATERIALS ELEVATION DEPTH LEGENC Drilling 110.0 to 167.7 P-13(m) previously SANDSTONE - Paluxy Fm. drilled 16 dec 85 to mostly weak to non cemente 3 Jan 86 to 110' (drill some scattered weak to moderate cementation, fine log available). Hole has grout grained, light grey, thin up to 80.2 within metal casing Plug from 52.2 to 52.8. lignite seams scattered throughout, silty and shaley with numerous thin seams throughout. 84.2 to 92.3' - 9 7/8" rockbit - refusal on a metal plug installed -, ÷ with grout. 92.3 to 92.0' - 6" diamond core. 92.3 to 167.8' - 9 7/8" 120 167.7 to 167.8 rockbit. _ -- -SHALE - greenish grey to Hole was gamma logged (natural) and well monwhite. itoring casing installed after drilling. Well Installation TD = 167.8Bottom of pump = 163.0' Pump intake = 160.5' " pvc pipe. connects pump to surface and 130. filter material placed around screep. A 5' sump placed below pump and 20' of .010 screen placed immedfately above pump. Samples Two samples taken at 140_ 167.8'. One vial of drill fluid and one vial of cuttings with distilled water added to fill vois within vial. Note: Robert MCVey pre-sent only during drilling portion, ie, 84.2 to 167.8'. Gerald Schoonover present for inspection during well installation.and logging.

Hele Ne. P-13(m)ext.

| DRILLING LOG | SVD | HETALLATION Ft W | orth | | OF 2 SHEETS |
|---|---------------------------|-------------------------|-------------------|---|----------------------------------|
| 1. PROJECT Paluxy Aquifer, AF | Plant #4 | M. SIZE AND TYPE | E OF SIT | SHOWN (750 - 100) | |
| Z. LOCATION (Conditions or 3 | | | | | |
| 1 DBILLING AGENCY | | 12 MANUFACTUR | ers design | HATION OF BAILL | |
| 4. HOLE NO. (As about on door and Me manhor) | ma tido! | 13. TOTAL NO. OF | OVER- | DISTURBED | UNDISTURGED |
| L NAME OF DRILLER | P-13(m)exatension | IL TOTAL NUMBE | R CORE DO |)XES | |
| <u>i_</u> | | IL ELEVATION G | | | |
| 6. DIRECTION OF HOLE | DES. FROM VERT. | IL DATE HOLE | RA TE | CON | PLETED |
| 7. THICKNESS OF OVERBURDS | | 17. ELEVATION TO | | | |
| 6. DEPTH DRILLED INTO ROC | | 19. TOTAL CORE I | | 20 1 1 1 1 7 | |
| 9. TOTAL DEPTH OF HOLE | 167.8' | | | KARAN MOV | |
| ELEVATION DEPTH LEGENC | CLASSIFICATION OF MATERIA | S CORE RECOV- ERY | SAMPLE NO. | REMAR! (Delling time, mater mediaring, etc., i) | loca, depth of I oldrillocati |
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MONITOR WELL P-13(M)

Mole No. 8A4C - 83

| Dest | LING LO | | (VISION | INSTALI | - | r h | | OF I SHEETS | 1 | |
|-------------|------------|-------------------------|---|---|--------------|-------------------------|------------------------|-------------------------------------|---|--|
| I. PROJECT | | | SWD | | NOT WOT | | ell auger 4th | | 1 | |
| Palux | y Aqui | fer Po | llution Investigation | 11. DAY | UN FOR E | EVATION | HIGHWATER _ HEL | OFE | 1 | |
| 2. LOCATION | d /Coardin | 10100 or 3 1 | ation) | | | *** | | | J | |
| DRILLING | AGENCY | rce Pi | ant #4) | 12. MANUFACTURER'S DESIGNATION OF ORILL | | | | | | |
| USCE-C | | | | Failing 1500 | | | | | | |
| 4. HOLE NO. | (As show | - | ing title | - ĐƯÀ | DEN SAMP | LES TAKE | 11 | 0 |] | |
| E HAME OF | DRILLER | | : 8A4C-83 | 14. TOT | AL NUMBE | R CORE | OXES 1 | |] | |
| | Brew | | | 18. ELE | VATION G | ROUND WA | TER *** | | 1 | |
| & DIRECTIO | | | | M. DAT | E HOLE | i | • | LETED | 1 | |
| - WERTI | CAL . | INCLINE | DEG. FROM VERT. | | | | Jul 85 | 11 Jul 85 | ┨ | |
| 7. THICKNES | S OF OVE | ERBURDE | 32.0 | $\overline{}$ | VATION TO | | | | 1 | |
| e. DEPTH DE | HLLED I | TO ROC | | | AL CORE | | Y FOR BORING | 39% | ┨ | |
| 9. TOTAL DE | EPTH OF | HOLE | 39.0 | | / | an | dy Mi | who . | ł | |
| ELEVATION | 0.5574 | LEGENO | CLASSIFICATION OF MATERIA | | 1 CORE | BOX OR SAMPLE HO. | (Drilling time, water | ers | 1 | |
| • | 500 | l | (Description) | | ERY | NO. | treathering, etc., | er loon, dopth of if eignificant | l | |
| | • | - | | | | | | | 士 | |
| i | = | 1 | 0.0 to 0.6' | | 1 | | *** | | E | |
| ì | l <u> </u> | ł | ASPHALT | | l | | l. Drilled | | Ł | |
| ł . | = | | 133.130. | | 1 | l A | | ater level | E | |
| |] = | } | 0.6' to 1.1' | |] | , '` ! | was 26.6' | After comple | F | |
| i | _ | 1 | BASE MATERIAL | | | <u> </u> | of hole, | • | F | |
|] | = | 1 | j | | ļ | | | hr check- | F | |
| [| = | Į | 1.1' to 19.5' | | ! | 13 | level was | | F | |
| | | ; | CLAY: | | İ | | | | F | |
| | = | 1 | 1.1' to 7.0' - med: | | [| | | | E | |
| 1 | | 1 | plas ticity, tan-bro | | 1 | | 2. JARS: | | 上 | |
| [| | 1 | medium stiff, moist | | L | l C I | A. 1.1 to B. 4.0 to | | E | |
| <u> </u> | = | ł | calcareous with scaline nodules. | ittere | f | | C. 7.0 to | | Е | |
| 1 1 | 10 | } | Ĭ | | ł | <u> </u> | D. 10.0 t | | F | |
| | ~ ¬ | ł | 7.0' to 19.5' - lo | | | | E. 13.0 t | | F | |
| 1 1 | - | | medium plasticity, | | 1 | D | F. 16.0 t | o 19.5 | F | |
| | | | medium stiff, moist calcareous, slight | - | | | G. 19.5 t | | F | |
| } . | | , | silty. | • 9 |] | | H. 23.0 t | | F | |
| l 1 | | |] | | | | I. 26.0 t | | E | |
|) | _ = | j | 19.5' to 32.0' | | 1 |) E | J. 29.0 t K. 31.0 t | | E | |
| 1 | ╛ | | GRAVEL, dense, well | | ĺ | [. 1 | x. 31.0 t | 0 32.0 | E | |
| | | İ | graded (fine to med | | ļ | - | 1 | | E | |
| i i | | | tan, moist, sandy, | | ł | i i | 3. Drilling | methods: | F | |
| | | | Borders on a grave | lly | | F | 0.0 to 32 | .0 auger | F | |
| i | \exists | | clay. | | ł | l ' | | 2.5 -rockbit | | |
| | 7 | | 32.0 to 39.0' | | | | 32.5 to 3 | 9.0 - 4" cor | F | |
| | 20 📑 | | LIMESTONE (Walnut fr | a) | | | | | 二 | |
| 1 | ~ 7 | | 32.0 to 38.1 -mode | | | | / After he | iling, hole | F | |
| | 7 | | hard, dark gray, for | - | | G | was backf | - | F | |
| 1 | \exists | | ferous, dark gray, ca | | Ļ | | | h neat cemen | Ł | |
| ! ! | ⇉ | | ous clay matrix. | | j | | grout. | | E | |
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| | ⇉ | | 38.1 to 38.4-modera | | | Н | C 17-2 | mnlas: | E | |
|]] | ⇉ | | hard, gray, fossilife | erous, | 1 | ' | 5. Water sa | mhrs2: | E | |
| } | \dashv | | clayey. | | j | J - | | | E | |
| 1 | Ⅎ | | 38.4' to 38.6'-clay | / seam | Ļ | 1 | | | E | |
| j i | | İ | soft, tan-gray, sandy | | } | I | | | F | |
| [| \exists | l | fossiliferous. | | [| | | | F | |
| | 3 | · | 30 (| | 1 | | | | F | |
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| | ⊣ | | hard, gray, fossil: clayey. | Lierou | В, | | | | F | |
| 1 | 7 | | Clayey. | | l | K | | | F | |
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| j j | | | 1 | | | <u> </u> | } | | F | |
| FMG BOOM | 10.31 | | US EDITIONS ARE DESCRIPTE. | | PROJECT | | L | HOLE NO. | | |
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| PAILEY AQUATE Pollution Investigation ALE FORCE Plant 80.47 (C. D.) 277 8.0 THE ANAPOPT PLANT 80.47 (C. D.) 278 8.0 THE ANAPOPT PLANT 80.47 (C. D.) 278 8.0 THE ANAPOPT PLANT 80.47 (C. D.) 278 8.0 THE ANAPOPT PLANT 80.47 (C. D.) 278 8.0 THE ANAPOPT PLANT 80.47 (C. D.) 278 8.0 THE ANAPOPT PLANT 80.47 (C. D.) 278 8.0 THE ANAPOPT PLANT 80.47 (C. D.) 278 8.0 THE ANAPOPT PLANT 80.47 (C. D.) 278 8.0 THE ANAPOPT PLANT 80.47 (C. D.) 278 8.0 THE ANAPOPT PLANT 80.47 (C. D.) 278 8.0 THE ANAPOPT PLANT 80.47 (C. D.) 278 8.0 THE ANAPOPT PLANT 80.47 (C. D.) 278 8.0 THE ANAPOPT PLANT 80.47 (C. D.) 278 8.0 THE ANAPOPT PLANT 80.47 (C. D.) 278 9.0 | | | | | | | | Hale No.5 | MAC - RA |
|--|-------------|-------------|----------------|---------------------------|--------------|----------|---------------|--------------------|--|
| PRINTY Aquifer Polintion Investigation PRINTY Aquifer Polintion Investigation OSCEN OSCEN OSCEND (19 Annual 10 OSCEN) Frever Section Control of Cont | Dett | ING I C | | | | | | | SHEET |
| PAINTY AQUIFE Polition Investigation SCHOOL STATE 18.07 (C. D.) 411 8.0 DERIVATION TO STATE 18.07 (C. D.) 241 8.0 DERIVATION TO STATE 18.00 DETITE 18.00 DETITE 18.00 DETITE 18.00 DETITE 18.00 DETITE 18.00 DETITE 18.00 DETITE 18.00 DETITE 18.00 DETITE 18.00 DETIT | I. PROJECT | | ~ | 310 | | | | 10" Anger/6" | |
| Delicition Assertion and advantage of the State of the St | Paluxy | Aquif | er Pol | lution Investigation | 11. DAY | A POR EL | EVATION | SHOWN (TOW or MAN | , |
| SOULT SERVICE STATES AND ASSESSED STATES OF THE SERVICE STATES OF | L LOCATION | ce Pis | nt No. | 4 (G. D.) 471 N. of | 12. MAME | PACTURE | ER'S DESIG | SNATION OF ORILL | |
| SAME OF CHILLES 17 O | 2 DRILLING | AGENCY | | | | | | XO | |
| SAME of SMILES THE FORM NUMBERS OF SAME SAME SAME SAME SAME SAME SAME SAME | 4. HOLE NO. | (As show | | | 13. TOT | | | DISTURGED | |
| Described Desc | and #10 nu | | | | 14 TOT | AL NUMBE | n cone | | · · · · · · · · · · · · · · · · · · · |
| Described of sold (Constitution of sold sold sold sold sold sold sold sold | S. NAME OF | DRILLER | | Brower | IS ELE | ATION G | ROUND WA | TER See commer | t 1 |
| TVELLENGE OF CONSTRUCTION OFFIN ORDITATION OF SALVERIALS OFF | S. DIRECTIO | H OF HOL | . « | | | | STA | RTED | OMPLETED |
| THURCHESS OF OUTSIDENESS OF CONTRIBUTES OF THE PARTY OF T | TVERTI | CAL [] | HCLINEC | DES. PROM VERT. | | | | | |
| SCHOOL STRUCKS ONLY EVALUATION OF WOLK CAMENICATION OF VERTICALS CAMENIC | 7. THICKNES | S OF OVE | RBURDE | | | | | | |
| LEVATION DEFIN LEGEND CLASSIFICATION OF WATERIALS \$1000 \$0000 \$00000 \$000000 \$000000 \$000000 \$0000000 \$00000000 | . DEPTH DE | HLLED H | ITO ROCE | 00.51 | | ATURE OF | MISPECT | OR/ | |
| O.0' to 0.6' Asphalt O.6' to 1.4' O.6' to 1.4' Gravel Base 1.4' to 17.4' CLAY: 1.4' to 17.4' CLAY: 1.4' to 17.0': medius to high plasticity; black; stiff; moist; calcareous. 7.0' to 11.0': high plasticity; tan - brown; very stiff: - bard; moist; calcareous. 1.1.0' to 1.1.0': high plasticity; reddish brown; very stiff; moist; calcareous. 1.1.0' to 1.1.0': medius to high plasticity; tan - brown; very stiff; moist; calcareous. 1.1.0' to 1.1.0': high plasticity; tan - brown; very stiff; moist; calcareous. 1.1.0' to 1.1.0': medius to high plasticity; tan - brown; very stiff; moist; calcareous. 1.1.0' to 1.1.0': medius to high plasticity; tan - brown; very stiff; moist; calcareous. 2. Jar Samples A. 1.4 - 4.0 C. 7.0 - 9.0 | . TOTAL O | EPTH OF | HOLE | | <u> </u> | | <u> </u> | | |
| O.0' to 0.6' Asphalt O.6' to 1.4' O.6' to 1.4' Gravel Base 1.4' to 17.4' CLAY: 1.4' to 17.4' CLAY: 1.4' to 17.0': medius to high plasticity; black; stiff; moist; calcareous. 7.0' to 11.0': high plasticity; tan - brown; very stiff: - bard; moist; calcareous. 1.1.0' to 1.1.0': high plasticity; reddish brown; very stiff; moist; calcareous. 1.1.0' to 1.1.0': medius to high plasticity; tan - brown; very stiff; moist; calcareous. 1.1.0' to 1.1.0': high plasticity; tan - brown; very stiff; moist; calcareous. 1.1.0' to 1.1.0': medius to high plasticity; tan - brown; very stiff; moist; calcareous. 1.1.0' to 1.1.0': medius to high plasticity; tan - brown; very stiff; moist; calcareous. 2. Jar Samples A. 1.4 - 4.0 C. 7.0 - 9.0 | ELEVATION | DEPTH | LEGENO | CLASSIFICATION OF MATERIA | LS | RECOV | SAMPLE NO. | Drilling time, and | nKS or ison, dopth of if circuitions |
| 24 hr. check — water level had dropped over night from ground leve to 27.0', caved to 57.5 he hole made to much water to bail dry. 1.4' to 17.4' CLAY: 1.4' to 7.0': medium to high plasticity; black; stiff; moist; calcareous. 10— 10— 10— 10— 10— 10— 10— 10 | • | • | | | | | | | |
| Level had dropped over- Gravel Base | | = | | 0.0' to 0.6' | | | | 1. Water Le | vel |
| Carel Base A Carel Base | ł |] _= | ! | <u>Asphalt</u> | | | | | |
| Gravel Base Gravel Base Cravel Base The hole made to much water to bail dry. The hole nade to much water to bail dry. 1014 0 34.8° 1015 1 33.2° 1016 2 32.1° 1017 3 32.1° 1018 4 33.8° 1018 4 33.8° 1018 4 33.8° 1018 4 33.8° 1018 4 33.8° 1018 4 33.8° 1018 4 33.8° 1018 4 33.8° 1018 4 33.8° 1018 4 33.8° 1018 4 33.8° 1018 4 33.8° 1018 2 22.7° 1018 4 33.8° 1018 4 31.8° 1018 2 32.1° 1018 4 33.8° 1018 4 33.8° 1018 2 32.1° 1018 4 33.8° 1018 4 33.8° 1018 4 33.8° 1018 4 34.8° 102.1 4.0° 1.4 4.0° 1.4 1.0° 1.4 4.0° 1.4 1.0° 1.4 20.0° 1.4 20.0° 1.4 20.0° 1.4 20.0° 1.2 20.0° 23.0° 4. 1.4 4.0° 1.4 1.0° 1.4 20.0° 1.4 20.0° 1.4 20.0° 1.2 20.0° 2. 3. 2. 3. 36.0° 2. 46.0° 2. 46.0° 2. 46.0° 2. 46.0° 2. 46.0° 2. 46.0° 2. 46.0° 2. 46.0° 2. 46.0° 2. 46.0° 2. 46.0° 2. 46.0° 2. 46.0° 2. 46.0° 2. 46.0° 2. 46.0 | | = | | 0 61 40 1 41 | | | Δ : | | |
| The hole made to much water to bail dry. 144' to 174' CLAY: 124' to 7.0': medium to high plasticity; black; stiff; moist; calcareous. 7.0' to 11.0': high plasticity; tan - brown; very stiff' - hard; moist; calcareous, with a few lime nodules from 9.0'; sandy. 100' to 14.0': medium plasticity; reddish brown; very stiff' moist; calcareous; with a few lime nodules from 9.0'; sandy. 11.0' to 14.0': medium plasticity; reddish brown; very stiff' moist; calcareous; with a few lime nodules from 9.0'; sandy. 200' The first moist; calcareous; silty. 21.10' to 17.4': low plasticity; tan; stiff; moist; calcareous; well graded (fine to medium gravel sizes and cobble sizes from 21.0'; clayey, sandy. 22. Dry Samples 23.0' to 23.0': low plasticity; tan; medium stiff - stiff; moist; calcareous; silty. 23.0' to 25.0': low plasticity; tan; medium stiff - stiff; moist; calcareous; silty. 25.0' to 29.0': medium plasticity; tan; medium stiff - stiff; moist; calcareous; silty. 25.0' to 29.0': medium plasticity; reddish brown; medium stiff - stiff; moist; calcareous; silty. 25.0' to 29.0': medium plasticity; reddish brown; medium stiff - stiff; moist; calcareous; silty. 26.0' to 29.0': medium plasticity; reddish brown; medium stiff - stiff; moist; calcareous; silty. 26.0' to 29.0': medium plasticity; tan; medium stiff - stiff; moist; calcareous; silty. 27.2'. Hole was casped off with premixed concrete. | | = | | | | | ~ | | |
| 144' to 17.4' 1015 13.5; 2' 1016 2 32.7' 1017 3 32.1' 1018 4 31.2' 10.2' 11.0 11 | | = | | Gravel Base | | | | The hole m | ade to much |
| la4' to 174' CLAY: 1.4' to 7.0': medium to high plasticity; black; stiff; moist; calcarecus. 10 T.0' to 11.0': high plasticity; tan - brown; very stiff' - hard; moist; calcarecus, with a few lime nothles from 9.0'; sandy. 11.0' to 14.0': medium plasticity; reddish brown; very stiff; moist; calcarecus; very sandy. 20 11.0' to 17.4': low plasticity; tan; stiff; moist; calcarecus; well graded (fine to medium gravel sizes and cobble sizes from 21.0'g clayey, sandy. 25.0' to 50.0' CLAY: 25.0' to 25.0': low plasticity; tan; medium stiff - stiff; moist; calcarecus; silty. 25.0' to 25.0': low plasticity; tan; medium stiff - stiff; moist; calcarecus; silty. 26.0' to 29.0': medium plasticity; tan; medium stiff - stiff; moist; calcarecus; silty. 27.0' to 50.0' CLAY: 28.0' to 26.0': low plasticity; tan; medium stiff - stiff; moist; calcarecus; silty. 28.0' to 29.0': medium plasticity; tan; medium stiff - stiff; moist; calcarecus; silty. 29.0' to 29.0': medium plasticity; tan; medium stiff - stiff; moist; calcarecus; silty. 29.0' to 29.0': medium plasticity; tan; medium stiff - stiff; moist; calcarecus; silty. 29.0' to 29.0' medium plasticity; tan; stiff; moist; calcarecus; well graded (fine to medium gravel sizes and cobble sizes from 21.0'g clayey, sandy. 29.0' to 50.0' CLAY: 21.0' to 22.0' to 50.0' to 62.0' - 7 7/9" rock bit. 22.0' to 50.0' to 50.0' to 50.0' to 50.0' to 6 | j | = | ! ! | | | | _ | | |
| CLAY: 1-4' to 7.0': medium to high plasticity; black; stiff; moist; calcareous. 7.0' to 11.0': high plasticity; tan brown; very stiff' hard; moist; calcareous, with a few lime plasticity; reddish brown; very stiff; moist; calcareous; very stiff; moist; calcareous; very stiff; moist; calcareous; very stiff; moist; calcareous; very stiff; moist; calcareous; well graded (fine to medium gravel sizes and cobble sizes from 27.0'g clayey, sandy. 23.0' to 25.0' to 50.0' CLAY: 25.0' to 29.0'; low plasticity; tan; medium stiff - stiff; moist; calcareous; silty. 26.0' to 29.0'; low plasticity; tan; medium stiff - stiff; moist; calcareous; silty. 27.2' moist calcareous; silty. 28.0' to 29.0'; low plasticity; tan; medium stiff - stiff; moist; calcareous; silty. 28.0' to 29.0'; low plasticity; reddish brown; medium stiff - stiff; moist; calcareous; silty. | ł | | | 1.4' to 17.4' | | | 8 | 1 | |
| 10 10 10 10 10 10 10 10 10 10 | | | | r | | | <u> </u> | 1016 2 | 32.7' |
| high plasticity; black; stiff; moist; calcareous. 7.0' to 11.0'; high plasticity; tan - brown; very stiff - hard; moist; calcareous, with a few lime nodules from 9.0'; sandy. 11.0' to 14.0'; medium plasticity; reddish brown; very stiff; moist; calcareous; very sandy. 11.0' to 14.0'; medium plasticity; reddish brown; very stiff; moist; calcareous; very sandy. 14.0' to 17.4'; low plasticity; tan; stiff; moist; calcareous; silty. 17.4' to 23.0' CRAYEL: dense; tan; moist; calcareous; silty. 17.50 to 50.0' CLAY: 23.0' to 50.0' CLAY: 25.0' to 50.0' CLAY: 26.0' to 29.0'; medium plasticity; reddish brown; medium stiff - stiff; moist; calcareous; silty. 26.0' to 29.0'; medium plasticity; reddish brown; medium stiff - stiff; moist; calcareous; silty. 26.0' to 29.0'; medium plasticity; reddish brown; medium stiff - stiff; moist; calcareous; silty. 27.2' 28. Jar Samples A. 1.4 - 4.0 R. 4.0 - 7.0 C. 7.0 - 9.0 D. 9.0 - 11.0 E. 11.0 - 17.0 C. 17.0 - 17.4 E. 17.4 - 20.0 I. 20.0 - 23.0 I. 20.0 - 23.0 I. 20.0 - 23.0 I. 20.0 - 23.0 I. 20.0 - 23.0 I. 26.0 - 29.0 I. 20.0 - 23.0 I. 26.0 - 29 | ſ | | | | | | _ | | |
| stiff; moist; calcareous. 7.0' to 11.0': high plasticity; tan - brown; very stiff' - bard; moist; calcareous, with a few lime nodules from 9.0'; sandy. 11.0' to 14.0': medium plasticity; reddish brown; very stiff; moist; calcareous; silty. 11.0' to 17.4': low plasticity; tan; stiff; moist; calcareous; silty. 17.4' to 23.0' GRAYEL: dense; tan; moist; calcalcareous; well graded (fine to medium gravel sizes), some coarse gravel sizes and cobble sizes from 21.0'g clayey, sandy. 20. 21.0' to 50.0' CLAY: 23.0' to 50.0' CLAY: 25.0' to 50.0' CLAY: 25.0' to 50.0' CLAY: 25.0' to 50.0' CLAY: 26.0' to 29.0': medium plasticity; tan; medium stiff' - stiff; moist; calcareous; silty. 26.0' to 29.0': medium plasticity; reddish brown; medium stiff' - stiff; moist; calcareous; silty. 26.0' to 29.0': medium plasticity; reddish brown; medium stiff' - stiff; moist; calcareous; silty. 27. Tar Samples A. 4.0 - 7.0 B. 4.0 - 7.0 C. 7.0 - 9.0 D. 9.0 - 11.0 E. 11.0 - 14.0 F. 14.0 - 17.0 G. 17.0 - 17.4 E. 11.0 - 14.0 F. 14.0 - 17.0 G. 17.0 - 17.4 E. 11.0 - 14.0 F. 14.0 - 17.0 G. 17.0 - 17.0 G. 17.0 - 17.4 E. 11.0' to 40.0 - 23.0 L. 26.0 E. 14.0 - 29.0 L. 29.0 - 32.0 L. 29.0 - 35.0 L. 29.0 - 35.0 L. 29.0 - 35.0 L. 29.0 - 36.0 O. 38.0 - 43.0 P. 45.0 - 46.0 Q. 46.0 - 48.0 O.0' to 41.0' - 10'' amger. 48.0' to 58.0' - 4'' core barrel. 58.0' to 62.0' - 7 7/8' rock bit. 9 bags of neat grout was poured into the hole and allowed to set for 20 hrs. To ef groat is at 27.2'. Role was backfilled with cuttings and left-over cuttings were placed in cloth sample bags the top 0.6' of the hole was capped off vith premixed concrete. | | = | | | | | | 1016 4 | 21.8' |
| Too' to 11.0': high plasticity; tan - brown; very stiff - bard; moist; calcareous, with a few lime nodules from 9.0'; sandy. 11.0' to 14.0': medium plasticity; reddish brown; very stiff; moist; calcareous; very sandy. 20 11.0' to 14.0': medium plasticity; reddish brown; very stiff; moist; calcareous; silty. 20 14.0' to 17.4': low plasticity; tan; stiff; moist; calcareous; silty. 21.1' to 23.0' CRAVEL; dense; tan; moist; calcareous; silty. 22.1' to 50.0' CLAY: 23.0' to 50.0' CLAY: 25.0' to 26.0': low plasticity; tan; medium stiff - stiff; moist; calcareous; silty. 26.0' to 29.0': medium plasticity; tan; medium stiff - stiff; moist; calcareous; silty. 26.0' to 29.0': medium plasticity; tan; medium stiff - stiff; moist; calcareous; silty. 26.0' to 29.0': medium plasticity; reddish brown; medium stiff - stiff; moist; calcareous; silty. 27.0' to 50.0' medium plasticity; reddish brown; medium stiff - stiff; moist; calcareous; silty. 28.0' to 50.0' of the hole was capped off vith premixed concrete. | | ۱., ⊐ | | | | | | 2. Jar Samp | es |
| 7.0' to 11.0': high plasticity; tan - brown; very stiff - hard; moist; calcareous, with a few lime nodules from 9.0'; sandy. 11.0' to 14.0': medium plasticity; reddish brown; very stiff; moist; calcareous; very sandy. 20 11.0' to 14.0': medium plasticity; reddish brown; very stiff; moist; calcareous; very sandy. 20 14.0' to 17.4': low plasticity; tan; stiff; moist; calcareous; silty. CRAVEL; dense; tan; moist; calcareous; silty. CRAVEL; dense; tan; moist; calcareous; silty. 23.0' to 50.0' CLAY: 23.0' to 50.0' CLAY: 25.0' to 50.0' CLAY: 26.0° to 29.0': medium plasticity; tan; medium stiff - stiff; moist; calcareous; silty. 26.0° to 29.0': medium plasticity; reddish brown; medium stiff - stiff; moist; calcareous; silty. 26.0° to 29.0': medium plasticity; reddish brown; medium stiff - stiff; moist; calcareous; silty. 27.0' to 50.0' medium plasticity; reddish brown; medium stiff - stiff; moist; calcareous; silty. 28.0' to 50.0' of the hole was capped off vith premixed concrete. | | 10 | | , | | | D I | | |
| plasticity; tan - brown; very stiff' - bard; moist; calcareous, with a few lime nodules from 9.0'; sandy. 11.0' to 14.0': medium plasticity; reddish brown very stiff; moist; calcareous; stiff; moist; calcareous; silty. 17.4' to 23.0' CRAVEL: dense; tan; moist; calcareous; well graded (fine to medium gravel sizes), some coarse gravel sizes and cobble sizes from 21.0'g clayey, sandy. 23.0' to 26.0': CLAY: 25.0' to 26.0': CLAY: 25.0' to 26.0': CLAY: 25.0' to 26.0': CLAY: 25.0' to 26.0': CLAY: 25.0' to 26.0': CLAY: C | ł | = | | 7 01 +0 11 010 24 | | | <u> </u> | | - |
| very stiff: hard; moist; calcareous, with a few lime nodmles from 9.0'; sandy. 11.0' to 14.0': medium plasticity; reddish brown: very stiff; moist; calcareous; very sandy. 14.0' to 17.4': low plasticity; tan; stiff; moist; calcareous; silty. 17.4' to 23.0' | | | | | | | _ | | |
| lime nothles from 9.0'; sandy. C. 17.0 - 17.4 17.4 - 20.0 | { | = | | | | |) E | | |
| sandy. Internation Intern | | | ' | | | | | | |
| Il.0' to 14.0': medium plasticity; reddish brown very stiff; moist; cal- careous; very sandy. 20 14.0' to 17.4': low plasticity; tan; stiff; moist; calcareous; silty. 17.4' to 23.0' GRAVEL: dense; tan; moist; calcareous; well graded (fine to medium gravel sizes), some coarse gravel sizes and cobble sizes from 21.0'g clayey, sandy. 25.0' to 50.0' CLAY: 25.0' to 50.0' CLAY: 25.0' to 29.0': medium plasticity; tan; medium stiff - stiff; moist; calcareous; silty. 26.0' to 29.0': medium plasticity; reddish brown; medium stiff - stiff; moist; calcareous; silty. | , | = | ļ , | , | •0'; | |] | | |
| 11.0' to 14.0': medium plasticity; reddish brown: very stiff; moist; calcareous; very sandy. 14.0' to 17.4': low plasticity; tan; stiff; moist; calcareous; silty. 17.4' to 23.0' 17.4' to 48.0' - 6" 17.4' to 48.0' to 48.0' to 48.0' to 48.0' to 48.0' to 48.0' t | | | | | | | F | I. 20.0 - | 23.0 |
| plasticity; reddish brown very stiff; moist; cal- careous; very sandy. 20 14.0' to 17.4': low plasticity; tan; stiff; moist; calcareous; silty. 17.4' to 23.0' CRAVEL: dense; tan; moist; calcareous; well graded (fine to medium gravel sizes), some coarse gravel sizes and cobble sizes from 21.0'g clayey, sandy. 23.0' to 50.0' CLAY: 23.0' to 50.0' CLAY: 23.0' to 26.0': low plasticity; tan; medium stiff = stiff; moist; calcareous; silty. 26.0' to 29.0': medium plasticity; reddish brown; medium stiff - stiff; moist; calcareous; silty. L. 29.0 - 32.0 M. 32.0 - 35.0 M. 32.0 - 35.0 M. 32.0 - 35.0 N. 32.0 - 33.0 P. 45.0 - 46.0 Q. 46.0 - 48.0 V. 41.0' to 48.0' - 6" amger. 48.0' to 58.0' - 4" core barrel. 58.0' to 62.0' - 7 7/8" rock bit. 9 bags of neat grout was soured into the hole and allowed to set for 20 hrs. Top of grout is at 27.2'. Hole was backfilled with cuttings and left- over cuttings were place over cuttings were place ded in cloth sample bags The top 0.6' of the hole was capped off with premixed concrete. |] | | | | | | | | |
| very stiff; moist; calcareous; very sandy. 14.0' to 17.4': low plasticity; tan; stiff; moist; calcareous; silty. 17.4' to 23.0' GRAVEL: dense; tan; moist; calcareous; vell graded (fine to medium gravel sizes), some coarse gravel sizes and cobble sizes from 21.0'; clayey, sandy. 23.0' to 50.0' CLAY: 23.0' to 50.0' CLAY: 25.0' to 29.0': medium plasticity; tan; medium plasticity; reddiah brown; medium stiff stiff; moist; calcareous; silty. 26.0'' to 29.0': medium plasticity; reddiah brown; medium stiff stiff; moist; calcareous; silty. | | 3 | | | | | 5 | | , - |
| carsons; very sandy. Carsons; very sandy. A | | | | | | • | | | |
| 14.0' to 17.4': low plasticity; tan; stiff; moist; calcareous; silty. 17.4' to 23.0' CRAVEL: dense; tan; moist; calcareous; well graded (fine to medium gravel sizes), some coarse gravel sizes and cobble sizes from 21.0'g clayey, sandy. 23.0' to 50.0' CLAY: Stiff - stiff; moist; calcareous; silty. 26.0' to 29.0': medium plasticity; reddish brown; medium stiff - stiff; moist; calcareous; silty. P. 43.0 - 46.0 Q. 46.0 - 48.0 Q. 46.0 - 48.0 A fulling Methods (0.0' to 41.0' - 10" anger. Set 8" steel casing to 41.0' to 48.0' - 6" anger. 48.0' to 58.0' - 4" core barrel. 58.0' to 62.0' - 7 7/8" rook bit. 9 bags of neat grout was poured into the hole and allowed to set for 20 hrs. Top of grout is at 27.2'. Hole was backfilled with cuttings and left over cuttings were placed in cloth sample bags the top 0.6' of the hole was capped off with premixed concrete. | | = | | | | | /+ | | |
| 14.0' to 17.4': low plasticity; tan; stiff; moist; calcareous; silty. 17.4' to 23.0' CRAVEL: dense; tan; moist; calcareous; well graded (fine to medium gravel sizes), some coarse gravel sizes and cobble sizes from 21.0'; clayey, sandy. 23.0' to 50.0' CLAY: 23.0' to 50.0' CLAY: 23.0' to 26.0': low plasticity; tan; medium stiff - stiff; moist; calcareous; silty. 26.0'' to 29.0': medium plasticity; reddish brown; medium stiff - stiff; moist; calcareous; silty. | | 20 | | | | | <u> </u> | | |
| plasticity; tan; stiff; moist; calcareous; silty. 17.4' to 23.0' CRAVEL: dense; tan; moist; calcareous; well graded (fine to medium gravel sizes), some coarse gravel sizes and cobble sizes from 21.0'g clayey, sandy. CLAY: 23.0' to 50.0' CLAY: 23.0' to 26.0': low plasticity; tan; medium stiff - stiff; moist; calcareous; silty. 26.0'' to 29.0': medium plasticity; reddish brown; medium stiff - stiff; moist; calcareous; silty. 25.0'' to 29.0': medium plasticity; reddish brown; medium stiff - stiff; moist; calcareous; silty. | İ | = | ! | 14.0' to 17.4': low | | | i | | |
| 17.4' to 23.0' GRAVEL: dense; tan; moist; calcareous; well graded (fine to medium gravel sizes), some coarse gravel sizes and cobble sizes from 21.0'; clayey, sandy. CLAY: CLAY: 23.0' to 50.0' CLAY: 23.0' to 50.0': low plasticity; tan; medium stiff - stiff; moist; calcareous; silty. 26.0'' to 29.0': medium plasticity; reddish brown; medium stiff - stiff; moist; calcareous; silty. O.0'' to 41.0' - 10'' anger. Set 8" steel casing to 41.0'. 41.0' to 48.0' - 6" anger. 58.0' to 58.0' - 4" core barrel. 58.0' to 58.0' - 7 7/8' rock bit. 9 bags of neat grout was poured into the hole and allowed to set for 20 hrs. Top of grout is at 27.2'. Hole was backfilled with cuttings and left-over cuttings were placed in cloth sample bags The top 0.6' of the hole was capped off with premixed concrete. | İ | Ξ | | plasticity; tan; st | iff; | | L | | |
| 23.0' to 50.0' CLAY: 23.0' to 26.0': low plasticity; tan; medium stiff - stiff; moist; calcareous; silty. 26.0'' to 29.0': medium plasticity; reddish brown; medium stiff - stiff; moist; calcareous; silty. | Í | ∵ ⊐ | | moist; calcareous; | silty. | | | 3. Drilling | <u>Methods</u> |
| 23.0' to 50.0' CLAY: 23.0' to 26.0': low plasticity; tan; medium stiff - stiff; moist; calcareous; silty. 26.0'' to 29.0': medium plasticity; reddish brown; medium stiff - stiff; moist; calcareous; silty. | | = = | | | | | , | | ,0° - 10° |
| 23.0' to 50.0' CLAY: 23.0' to 26.0': low plasticity; tan; medium stiff - stiff; moist; calcareous; silty. 26.0'' to 29.0': medium plasticity; reddish brown; medium stiff - stiff; moist; calcareous; silty. | 1 | | | 17.4' to 23.0' | | | 5 | | l casing to |
| 23.0' to 50.0' CLAY: 23.0' to 26.0': low plasticity; tan; medium stiff - stiff; moist; calcareous; silty. 26.0'' to 29.0': medium plasticity; reddish brown; medium stiff - stiff; moist; calcareous; silty. | | \exists | | | | | 1 | 41.0'. | |
| 23.0' to 50.0' CLAY: 23.0' to 26.0': low plasticity; tan; medium stiff - stiff; moist; calcareous; silty. 26.0'' to 29.0': medium plasticity; reddish brown; medium stiff - stiff; moist; calcareous; silty. | ļ | - | | calcareous; well grad | ed | | <u> </u> | | 0.0° - 6° |
| 23.0' to 50.0' CLAY: 23.0' to 26.0': low plasticity; tan; medium stiff - stiff; moist; calcareous; silty. 26.0'' to 29.0': medium plasticity; reddish brown; medium stiff - stiff; moist; calcareous; silty. | | 3 | | | | | ν · | | 1-01 - 41 |
| 23.0' to 50.0' CLAY: 23.0' to 26.0': low plasticity; tan; medium stiff - stiff; moist; calcareous; silty. 26.0'' to 29.0': medium plasticity; reddish brown; medium stiff - stiff; moist; calcareous; silty. | J | = | | | | | \ ^ | | |
| 23.0' to 50.0' CLAY: 23.0' to 26.0': low plasticity; tan; medium stiff - stiff; moist; calcareous; silty. 26.0'' to 29.0': medium plasticity; reddish brown; medium stiff - stiff; moist; calcareous; silty. | Ì | ╡ | | | - p r | | | | .0' - 7 7/8° |
| 23.0' to 50.0' CLAY: 23.0' to 26.0': low plasticity; tan; medium stiff - stiff; moist; calcareous; silty. 26.0'' to 29.0': medium plasticity; reddish brown; medium stiff - stiff; moist; calcareous; silty. | } | <u>,,</u> | | | | | , | | est mm. |
| CLAY: CLAY: | | ~- | 1 | 23.0' to 50.0' | | | L | | |
| 23.0° to 26.0°: low plasticity; tan; medium stiff - stiff; moist; calcareous; silty. 26.0° to 29.0°: medium plasticity; reddish brown; medium stiff - stiff; moist; calcareous; silty. 27.2°. Hole was backfilled with cuttings and left-over cuttings were place ed in cloth sample bags The top 0.6° of the hole was capped off with premixed concrete. | 1 | \exists | | | | | | hole and al | lowed to set |
| brown; medium stiff - stiff; moist; calcareous; silty. | - | | | | | | <u> </u> | for 20 hrs. | |
| brown; medium stiff - stiff; moist; calcareous; silty. | ļ | | | | | | | | T IS AT |
| brown; medium stiff - stiff; moist; calcareous; silty. | i | J | | | | | " | 1 _ · | ckfilled |
| brown; medium stiff - stiff; moist; calcareous; silty. | } | = | | | - 7 | | | with cuttin | gs and left- |
| brown; medium stiff - stiff; moist; calcareous; silty. | ł | 7 | | | | | | over cutting | gs vere plac |
| brown; medium stiff - stiff; moist; calcareous; silty. | } | 1 | | 26_0# to 29_01. ==4 | ins. | | N | | |
| brown; medium stiff - stiff; moist; calcareous; silty. | } | \exists | | | | | 1 | hole was ca | pped off |
| silty. | | | ' | brown; medium stiff | - | | | with premix | ed concrete. |
| | į | | | | recus; | | 0 | | |
| IG PORM 10.24 | NO 800:: | | | 442414 | | | <u> </u> | L | |

ENG FORM 1836 PREVIOUS EDITIONS ARE OSSOLETE. Paluxy Aquifer Pollution: Invest.

HOLE NO. 844C - 84

Hele No. 844C - 84

| | LING LO | E | SWD | | ort Wor | | | OF 2 SHEETS |
|----------|---------------------------------------|------------|--|----------|------------|-------------------------|-----------------|--|
| Paluxy | A ₀ uife | r Poll | ution Investigation | 10. SIZE | AND TYPE | EVATION | 10" Augor/6" | Auger |
| LOCATION | (Coordin | atoc or St | 4 149) | 1 | | | NATION OF DRILL | |
| DRILLING | AGENCY | | | 12. MAN | | g 1500 | MATION OF BRILL | |
| HOLE NO. | (As show | | USCEC | 13. TOT | AL NO. OF | | H 17 | CBERUTEIGNU |
| HAME OF | | | 8A4C - 64 | 14. TOT | AL NUMBE | R CORE B | OXES | |
| MARK UP | ORICLEN | | irever | IL ELE | ATION G | NOUND WA | TER See comm | ent 1 |
| DIRECTIO | | | | IS. DAT | _ | STA | NTED | OMPLETED |
| X VERTI | | | | 17. ELE | ATION TO | | | 14 July 85 |
| DEPTH DE | | | 707 | | | | FOR BORING | |
| TOTAL DE | | | 62.0 | 19. SIGN | ATURE OF | INSPECT | Randy | Fredul |
| EVATION | DEPTH | LEGEND | CLASSIFICATION OF MATERIA | LS | S CORE | BOX OR SAMPLE NO. | (Drilling (ma. | ARKS |
| | | | (Deceription) | | ERY | NO. | watering, etc | Mar less, depth of L. If significant) |
| | | | 49.0 | | | | | |
| | = | | 23.0' to 50.0' | | | 0 | | |
| | \equiv | | CLAY: | | | l i | | |
| | | | 29.0' to 46.0': lor | | | | | |
| | == | | plasticity; tan - r brown; medium stiff | | L . | ا ہ | | |
| | | | moist; calcareous; | | |] | | |
| | | | | | | - | | |
| | = | | 46.0' to 48.0': med | ium to | | 2 | | |
| | -] | | high plasticity; re | ddish | | ├ | | |
| | | | brown; very stiff; calcareous. | moist | | | | |
| | 50 | | | | | | | |
| | \exists | | | | | [[| | |
| | | | 48.0' to 61.5' | | |) [| | |
| | | | GRAVEL: determined fr | 03 | | | | |
| | _= | | small core sample and drilling action. | l | | | | |
| | 1 | | diriting action. | | | | | |
| į | | | | | | | | |
| | | | 61.5' to 62.0' | | | | | |
| | = | | Walnut Formation (?) | | | | | |
| | | | Determined from r | ock | | | | |
| | \exists | | bit cuttings. | | | | | |
| | 60 | | | | | | | |
| | = | | | | | | | |
| | | | | | | | | |
| j | | | T.D. 62.0 | | | | | |
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| | E | | | | | | | |
| | = | | | | | | | |
| | = | | | | | | | |
| G FORM | 10.14 | | US EDITIONS ARE DESOLETE | | PROJECT | | | HOLE NO |

| | | | | | | | Hole No. 844C - 85 | |
|------------|------------|---------|---|----------|-----------------------|--|--|-------------|
| DRIL | LING LO | | SVD | POT | ATION t Wort | h | SHEET OF 2 SHEETS | 1 |
| I. PROJECT | | | | 10. SIZE | AND TYP | OF BIT | 10" Auger / 4" Carboloy | 1 |
| Latrita | | | lution Investigation | II. DAY | IN FOR E | EVATION | SHOWN (TEN - MEL) | 1 |
| _ | Air P | orce P | lant No. 4 | 12. MAN | _ | | SHATION OF DRILL | 1 |
| | | 1 | USCEC | 13. 707 | AL NO. OF DEM SAMP | Biling OVER- | | ┨ |
| AND MO ME | (As also | - | 8AAC - 85 | | | | | 4 |
| . NAME OF | DRILLER | | rever | IL ELE | AL HUMBE | R CORE I | oxes 1 | ่า |
| L DIRECTIO | N OF HO | | | H. DAT | | STA | RTED COMPLETED | 1 |
| X VERTI | CAL | INCLINE | DES. FROM VERT. | <u> </u> | VATION TO | | | ┨ |
| . THICKNES | | | | | | | Y FOR BORING 92 % | 1 |
| . DEPTH DR | | | 65.5 | 19. SIGN | ATURE OF | INSPECT | ander Mieleuh | |
| ELEVATION | | 1 | CLASSIFICATION OF MATERIA | L.S | S CORE | BOX OR | REMARKS (Drilling time, mater loos, depth of | 1 |
| • | b | • | (Dooartpeisen) | | ERY | SAMPLE NO. | readering, etc., if eignificant) | |
| | _ | | 0.0' to 0.4' | | | | | E |
| | = | 1 | Asphalt | |] | A | 1. Water Level | F |
| | Ξ | | we have a | | | | 24 hr. check with a hole depth of 55.0' - | E |
| | = | | 0 41 +0 52 01 | | • | 8 | water at 24.1' and | F |
| | 10 | | 0.4' to 52.0' | | | - | caved below 37.7'. | E |
| | = | | CLAY: | | | 1 c | | þ |
| | Ξ | | 0.4' to 4.3': high plasticity; red bro | | | _ | 2. <u>Jar Samples</u> | E |
| | = | | dark red brown; ver | y stif | r; | | A. 0.4 - 2.4 B. 2.4 - 4.3 | þ |
| | Ξ | | damp; calcareous; s | andy. |] | D | C. 4.3 - 7.0 | E |
| | ., = | | | | | | D. 7.0 - 9.0 E. 9.0 - 14.0 | þ |
| | 10 — | | 4.3" to 9.0': meding high plasticity; re | | n. | | F. 14.0 - 17.0 | E |
| | = | | stiff - very stiff; | damp; | | Ε | G. 17.0 - 20.0 E. 20.0 - 23.0 | E |
| | | | calcareous, with li | | ier | | E. 20.0 - 23.0 I. 23.0 - 26.0 | F |
| | Ξ | | sandy. | , | | | J. 26.0 - 29.0 | E |
| | | | | | | | K. 29.0 = 32.0 L. 32.0 = 36.0 | F |
| Í | Ξ | | 9.0' to 17.0': low | | | بَر ا | M. 36.0 - 39.0 | E |
| | = | | <pre>plasticity; tan - re brown; medium stiff</pre> | | | ′ | W. 39.0 = 42.0 V. 42.0 = 45.0 | F |
| | | | stiff; moist; calcar | | | | P. 45.0 - 48.0 | E |
| | | | silty. | , | | 6 | Q. 48.0 - 52.0 R. 52.0 - 55.0 | F |
| | | | | | | 9 | S. 55.0 - 59.0 | E |
| İ | 20 — | | 17.0' to 29.0': med: high plasticity, with | | | | | F |
| l | | | low plasticity zone | from | | Н | 5. <u>Drilling Methods</u> | E |
| | _ | | 20.0' to 23.0'; tan; | | 130 | ′′ | 0.0' to 59.0' - 10" | E |
| 1 | Ξ | | stiff - stiff; moist careous; silty from | | | | auger. Set 8" steel casing to | E |
| | _ | | • | | | | 59.0°. Had a hard time | ıЕ |
| ļ | Ξ | | 29.0' to 32.0': his | zh. | | I | setting due to caving and sand zone above the | Ė |
| | 1 | | plasticity; red brow | MD: | | | Walnut Limestone. | E |
| 1 | Ξ | | stiff - very stiff; calcareous, with abu | | | _ | 59.0' to 59.5' - 7 7/8' rock bit. | " = |
| | = | | lime nodules and lis | eston | | J | 59.5' to 65.5' - 4" | E |
| | 7 | | clasts; gravelly (figrained). Pirst sign | ine | + | | core barrel. | Ļ |
| | % <u>~</u> | | at 30.0'. | | 1.01 | ر ا | Bailed the hole to 58.6 and then poured in 12 | È |
| | = | | 32.0' to 52.0': his | | | * | bags of neat grout. The | ١E |
| | = | | plasticity; tan - re | d | | <u> </u> | top of the grout in the hole is at approximatel | 1 |
| ļ | | | brown; stiff - very moist; calcareous. | stiff | } |] | 19.0'. | F |
| ł | | | morse cercerands | | | L | The remainder of the hole was backfilled wit | F |
| } | 7 | | | | | | cuttings. | E |
| 1 | | | | | | <u> </u> | All cuttings had been | E |
| | | | | | | <u></u> | bagged directly upon re moval from the hole and | E |
| | \exists | | | | | m | those cuttings not used | |
| ļ | Ξ | | | | | | to backfill the hole were storedin the area | F |
| | | | | | | N | provided by G. D. | E |
| G FORM | 1836 | PREVIOL | IS EDITIONS ARE OBSOLETE. Palts | | PROJECT | | HOLE NO. | |

ENG FORM 1836 PREVIOUS EDITIONS ARE OSSOLETE. Paluxy Aquifer Pollution Investigation 8AAC = 85

Hele No. 8440 - 85

| | | | | | | | | 8440 - 85 |
|---------|------------|--------------------|--|----------|-------------------------|---------------|-------------------|--|
| DEILL | JNG LO | | VISION SWD | FO | Ation rt Wort | :h | | SHEET Z |
| ROJECT | | | | | | | O" Auger / 4 | Carboloy |
| | | | ollution Investigation | II. BATU | B FOR EL | EVATION | SHOWN (YOU - ME | , |
| | | | ant No. 4 | | | | | |
| RILLING | | | | 12. MANU | | | SHATION OF DRILL | |
| | | | USCEC | 13. 7074 | | ng 150 | | UNDISTURBED |
| OLE NO. | (As she | | ng ride! | BURE | L NO. OF EN SAMPL | ES TAKE | M 10 | 0 |
| | DRILLER | | | 14. TOT | L NUMBE | R CORE I | OXES | 1 |
| | | Br | rever | IL ELEV | ATION GE | OUND WA | TER See comme | nt 1 |
| RECTIO | OF HOL | E | | IS. DATE | | STA | RTED C | OMPLETED |
| VERTIC | AL | HCLINED | DES. FROM VERT. | <u> </u> | | | | 19 July 85 |
| HICKNES | S OF OVE | ROURDE | N 59.0 | | ATION TO | | | |
| EPTH DR | ILLED IN | TO ROCK | 6.5 | | ATURE OF | | FOR SORING | 92 * |
| OTAL DE | PTH OF | +OLE | 65.5 | 1 | | A | andy hil | buch |
| VATION | DEPTH | LEGEND | CLASSIFICATION OF MATERIA | 5 | S CORE RECOV- ERY | BOX OR | (Delling time, to | MKS |
| - 1 | 40 . | | (Decempion) | | ERY | SAMPLE NO. | | , if elemificant |
| | | | | | | | | |
| | ∃ | | 53 01 ÷= 50 01 | | | N | 4 3545 5 | M = 67 /= |
| { | _= | | 52.0' to 59.0' | | | | | M - 83 is 3.8' south |
| | \exists | | SAND: loose; tan; wet | ; cal- | | | | and 14.8 |
|] | ⊣ | | careous; poorly grade | | | 0 | west of pa | |
| - { | -7 | | (fine grained); some | clay. | | | fence. | . 5 |
| | コ | | | | | | 8A4C - 84 | is located |
| 1 | ⇉ | | | | | | 468.9' noz | th of HM - |
| ŀ | | | <u>59.0'</u> to <u>64.9'</u> | | | ח | | 9' west of |
| ŀ | ∃ | | LIMESTONE (Walnut For | mation |) | P | | g lot fence. |
| 1 | _= | - | 59.0' to 60.5': mod | lerate | Ī | | | is located the of 8A40 - |
| - | \exists | | ly hard; tan; highl | | | | | 9' west of |
| ł | 7 | | weathered, iron sta | | | l | fence line | |
| | 50 — | | very fossiliferous, | | | Q | | |
| | コ | | generally the fossi | | . | ٦ | ļ | |
| - | コ | ļ | consist of (cyster) calcareous clay mat | | -, | 1 | { | |
| | | | From 60.2' moderate | | d: | | † | |
| ł | Ⅎ | | gray; weathered; ve | | , , | | ł | |
| | _= | | fossiliferous; dark | | | R | | |
|) | \exists | | calcareous clay mat | | | j . | J | |
| | コ | | | | | t | † • | |
| | | | (0.5%) | | | | 1. | |
| - 1 | 7 | | 60.5' to 62.4': mo | | ΤÀ | 5 | l ' | |
| 1 | ⇉ | | hard; gray; weather less fossiliferous, | | | را | ļ | |
|) | 7 | | ls generally in sma | | | 1 |) | |
| } | ⇉ | <u> जिल्</u> | pieces; becoming ve | | 59.5 | | † | |
| | 60- | <u>{-</u> -; ≥ - | argillaceous. | | . 0.2 | | 1 | |
| İ | ~ <u>∃</u> | 1-1212 | | | 60.5 | 30× | 1 | |
| ŀ | | 1 | (0.40.) (7.51.) | | AUNL LOO | l ' | | |
| - 1 | → | | 62.4" to 63.8": so | | - 0.0 | 1 | 1 | |
| | 7 | | gray; weathered; ve argillaceous; fewer | | , | | 1 | |
| l | コ | إلكبا | fossils. | • | 63.5° | ł | | |
| - 1 | −; | 1719 | From 63.3' - modera | ately | L - Q3 | 1 | [| |
| 1 | בֹד | - 1 7-19 | hard; gray; weather | | 65.5 | 1 | 1 | |
| j | | | broken shell pieces | в. | | 1 | 1 | |
| j | ∃ | | | | | | 1 | |
| |] | | (7.01.4. (4.01. | | | | 1 | |
| ĺ | | | | oder- | | [| ĺ | |
| ļ | ヸ | | etely hard; gray; of ered; very fossili: | | | 1 | 1 | |
| | = | | (oyster) shells; a | | 1 | 1 | 1 | |
| | 70- | | pyrite crystals; 30 | | | | | |
| | ⇉ | | dark gray calcareo | | | 1 | 1 | |
| 1 | _= | | clay matrix. | | | 1 | | |
| ļ | \exists | | · | | | | | |
| - { | ₹ | | | i | | l l | l . | |
| ļ | _크 | | 64.9° to 65.5° | | } | 1 | 1 | |
| | コ | İ | SILTSTONE : soft; h | lue | } | 1 | 1 | |
| [| ヸ | | green; calcareous; co | | | | | |
| | -1 | | small pockets of a gr | Leen | | | 1 | |
| ł | | i | gray clay (0.05' x 0. | ،۱۱). | | l | 1 | |
| | | | | | | | 1 | |
| l | = | | | | |] | } | |
| | | | T.D. 65.5'. | | 1 | 1 | | |

METALLATION T 1 2 sheets DRILLING LOG PAULE ID. SIZE AND TYPE OF BIT * Paluxy Aquifer Pollution Investigation LOCATION (Coards 2 MANUFACTURER'S DESIGNATION OF DRILL 4(General Dynamic 12 TOTAL NOT OF OVER-USCE HOLE NO. (As ale IL TOTAL HUMBER CORE BOXES IL ELEVATION GROUND WATER Merva ECTION OF HOLE M. DATE HOLE VERTICAL DINCLINED 21 July 85 17. ELEVATION TOP OF HOLE 648.98 THICKNESS OF OVERBURDEN 59.9 18. TOTAL CORE RECOVERY FOR BORING DEPTH DRILLED INTO ROCK 19. SIGNATURE OF INSPECTOR Robert McVer B. TOTAL DEPTH OF HOLE 65.0 S CORE CLASSIFICATION OF MATERIALS REMARKS ELEVATION DEPTH LEGENO * Drilling 0.0 to 0.4 - Asphalt. 0 to 60' - 8" auger, 0.4 to 59.9 set 5' csng, 60 to 65' - 4" core. B CLAY ε Auger refusal at 60'. 0.4 to 2.4 - medium to low plasticity, medium stiff, dry, dark brown, sandy and Water first observed gravelly. during the 24 to 25' run 2.4 to 3.1. - high to medium on 22 July 85. plasticity, medium stiff, On 23 July - water at slightly moist, black. F 22'. 3.1 to 4.5 - medium to 10 high plasticity, medium stiff, very dark brown, G silty. Jars 4.5 to 6.5 - high plast, stiff, slightly moist, 0.4 to 2.4 2.4 to 3.1 В. 4.5 dark red brown, silty to c. 3.1 to slightly gravelly. D. 4.5 to 6.5 6.5 to 7.7 6.5 to 7.7 - high plast, very stiff, slightly 7.7 to 10.0 F. G. 10.0 to 15.0 moist, reddish yellow, H. 15.0 to 20.0 H caliched, silty, slightly I. 20.0 to 25.0 sandy, gravelly. J. 25.0 to 30.0 7.7 to 10.0 - low that K. 30.0 to 35.0 grades to medium plasti-L. 35.0 to 40.0 city, very stiff, slightl M. 40.0 to 45.0 moist, yellow, very sandy N. 45.0 to 50.0 silty, calcareous. 0. 50.0 to 55.0 P. 55.0 to 59.9 10.0 to 15.0 - high plast, very stiff to stiff, slightly moist, red yellow, silty, scattered sand sized lime nodules. 15.0 to 50.0 - high/medium J plasticity, medium stiff to scattered soft seams. moist, red yellow with yellow brown, silty and sandy, soft sand seam at 28.7 to 29.2', some light gray pockets(silt), some shells from 41 to 45'. K 50.0 to 59.9 - high to medium plasticity, stiff to very stiff, moist, brownish yellow and light gray, few ferriginous clasts scattered within, few sandy lime nodules. L sand/silt seams at: 58.9 to 58.9', and 59.8 to 59.9 has shaly appearance w/ s ENG FORM 18 36 PREVIOUS EDITIONS ARE OSSOLETE.

DRILLING LOG AUTET W. SIZE RED TYPE OF BIT Paluxy Aquifer Pollution Investigation LOCATION (Co. 12 MANUFACTURER'S DESIGNATION OF CRILL AF#4 (GD) 13. TOTAL NO. OF OVER-HOLE NO. (As about an drawing title 14. TOTAL HUMBER CORE BOXES L HAME OF DRILLER IS ELEVATION SHOUND WATER DIRECTION OF HOLE 16. DATE HOLE VERTICAL MINCLINED 17. ELEVATION TOP OF HOLE 7. THICKNESS OF OVERBURDEN IS. TOTAL CORE RECOVERY FOR BORING DEPTH DRILLED INTO ROCK 19. SIGNATURE OF INSPECTOR Kobert Mele TOTAL DEPTH OF HOLE SCORE BOX OR RECOVERY HO. REMARKS CLASSIFICATION OF MATERIALS 59.9 to 62.2 ARGILLACEOUS LIMESTONE weather stained until 60.7 М then an unweathered dark gray and white, jointed, massive, soft shale to hard/very hard L.S. (rock classification), moderately to well cemented, oyster shells scattered, shale N seams scattered throughout and usually grades to marl 0 Box LOST 1.3" L + 3' C 0.8

Hele No. 8A4C-86

ENG FORM 1836 PREVIOUS EDITIONS ARE OSSOLETE.

| | | | | | | | Hele N | le 3À4C−87 | _ | |
|--------------|---|---------------------|--|---|-----------|---------------|----------------------|---------------------|--|--|
| DRILL | LING LO | _ | SOUTHWESTERN | BODG | | | | SHEET 1 OF 2 SHEET | | |
| I. PROJECT | | | | | WORT | | 8"AUGER 4 | | - | |
| GENER | | | | 10. SIZE AND TYPE OF SIT 8 "AUGER, 4"CORE | | | | | | |
| 2. LOCATION | V A OII | ates er Sid T당다다 | INVESTIGATION | | | | | | | |
| 1 DAILLING | AGENCY | <u> </u> | INVESTIGATION | IZ. MANG | UFACTURE | | NG 1500 | ·F | | |
| USCE | | | | 12 707 | AL NO. OF | | | UNDISTURBED | <u>, </u> | |
| 4. HÖLE HO. | (Ae about | - | 8A4C-87 | BURG | DEN SAMP | LES TAKE | 11 | 0 | | |
| E. NAME OF | DRILLER | | : 5A4C=57 | | AL NUMBE | | | 1 | | |
| BREW | | | | IL ELEV | VATION G | _ | | | | |
| 6. DIRECTION | | | | M. DATI | E HOLE | | 2/1/86 | 2/1/86 | | |
| E VERTIC | EAL | HCLINED | DEG. PROM VERT. | 17 61 61 | VATION TO | | | 49.29 | \dashv | |
| 7. THICKNES | S OF OVE | REUROE | 37.5 | | | | | 100% | ⊣ | |
| B. DEPTH OR | HLLED IN | TO ROCK | 4.0 | | ATURE OF | INSPECT | OR | 100/6 | 7 | |
| 9. TOTAL DE | EPTH OF | HOLE | 41.5 | <u> </u> | | | udette. | | | |
| ELEVATION | DEPTH | LEGEND | CLASSIFICATION OF MATERIA (Description) | L | RECOV | SAMPLE NO. | (Drilling time | MARKS | 1 | |
| _ • . | | | | | ERV | HO. | | te., if eignificant | - 1 | |
| | 0.0 | | | | | | | | F | |
| | 7 | | 0.0 to 0.4 | | 1 | [A | | ee water | F | |
| | | | ASPHALT, good cond | 11+10 | | | | red during | | |
| | | ļ | TOTICHE, EOOG CORE | 0101 | Γ | | | g to top o | ヸ゙゙ | |
| | ▏╡ | - 1 | a # += a =+ | | | | primary. | | F | |
|] | | | 0.4 to 2.5 | | | | | t primary coring. | ᅡ | |
| | l ∃ | | CLAY, medium to hi | igh | | | | depth-dry | .E | |
| l i | ーコ | | plasticity, stiff, | , | | <u> </u> | | | E | |
| | ∃ | | moist, brown. | | 1 | | | | E | |
| | Ⅎ | i | • | | | ١ ـ | 1 | | Е | |
| | <u> </u> | 1 | | | | 9 | 2) 1175 | | F | |
| | \exists | İ | 2.5 to 6.0= | | | ĺ | 2) <u>JARS</u> | | F | |
| · | 10.0 | | CLAY, low to media | ım | | | A) 0.0-2 | | F | |
| | 70-4 | ŀ | plasticity, soft, | Ì | | | B) 2.5-5 | | – | |
| 1 | 7 | 1 | moist, reddish-bro | own. | | Ì | C) 5.0-6 D) 6.0-1 | | F | |
| 1 | ー | } | | 1 | | E | E) 10.0- | | ⋷ | |
| | = | ŀ | 6.0 to 37.5 [±] | | | _ | F) 15.0- | 20.0 | ⊨ | |
| | = | | CLAY, low plastic | ity. | | | G) 20.0- | | E | |
| | ᆿ | | soft, moist, sandy | 7 | | | H) 25.0- | | E | |
| | ∄ | | throughout, small | limy | | - | I) 30.0- | 35.0 | E | |
| | 二 | J | nodules and blebs | | | | J) 35.0- | .37.5 | E | |
| ĺ | ⊣ | | throughout, tan. | · { | | | • | | E | |
| | ⊐ | | | | | F | | | E | |
| | ======================================= | | 37.5 to 41.5 | - 1 | | | | | E | |
| | Ⅎ | ł | LIMESTONE, tan to | - | | | 3) CARTO | NS | F | |
| : | 20.65 | i | brown along basal | • 1 | | | o carto | n samples | F | |
| | E | ! | section, fine to | 1 | | | | up | F | |
| 1 | \exists | - 1 | coarse grained, | ., | | | | | F | |
| i | 크 | - 1 | fossiliferous, bac | | | 6 | | | F | |
| i | \exists | | weathered to 39.7 | | | Ť | | | F | |
| 1 | ⊣ | - 1 | fractured, soft. | | | | 4) <u>DRIL</u> | LING | F | |
| | \exists | | | | | | 0.0 - 37 | .5, 8"auge | rF | |
| 1 | ∃ | | | | | | refusal | at top of | F | |
| 1 | \exists | | T.D41.5° | | | | limeston | е. | F | |
| 1 | ∃ | ļ | |] | | н | 37.5 - 4 | 1.5, 4"cor | ·e 🏲 | |
| | ્∓ | | | ļ | | " | | | F | |
| | 3 | | | l | | | Remarks | | . ⊨ | |
| | 7 | | | | | | | g advanced | · F | |
|]: | 30.4 | | | | | | and ream | f primary | ᆫ | |
| ľ | コ | - 1 | | | | | | | E | |
| - | ヸ | - 1 | | ! | | | B) After | coring, | E | |
| į | コ | | | ! | | 1 | | ailed. 4" | + | |
| | # | | | | | | | ole groute | | |
| ļ | ュ | | | | | | | PVC insert | | |
| 1 | ⇉ | | | | | | with PVC | being slo | | |
| 1 | Ⅎ | ŀ | | ļ | İ | | withdraw | m during | F | |
| ļ | | | | ŀ | | J | grouting | | \cdot F | |
| ŀ | Ⅎ | i | | ļ | | | C) Boring | subsequen | ır 🏧 | |
| | | 尹 | | Ì | 325 | | backfill cuttings | | F | |
| | | | | | . 1. | l | caretings | • | | |
| 1 | ⅎ | | | ı | | 1 | | | - | |
| 1. | 焦点 | | | ŀ | ão | 1 | | | F | |
| NG FORM | 40.0 | 艺 | S EDITIONS ARE OBBOLETE. | | | 1 | | HÔLE NO. | Ŀ | |

Hole No. 8A4C-87 METALLATION DRILLING LOG SOUTHWESTERN PORT WORTH OF BIT 8 "AUGER 4" CORE
TI. DATUM FOR ELEVATION BROWN (138 - OF 2 SHEETS PROJECT GENERAL DYNAMICS
LOCATION (COMMISSION STATES)
PALUXY AQUIPER INVESTIGATION
DONLING AGENCY 12. MANUFACTURER'S DESIGNATION OF BRILL FAILING 1500 USCE 13. TOTAL NO. OF OVER-HOLE HO. (As a ō 8A4C-87 HAME OF DRILLER 14. TOTAL NUMBER CORE BOXES IL ELEVATION GROUND WATER ** BREWER 2/1/86 COMPLETED 16. DATE HOLE 2/1/86 SVERTICAL DINCLINED 17. ELEVATION TOP OF HOLE 7. THICKNESS OF OVERSURDEN 37.5 18. TOTAL CORE RECOVERY FOR BORING 100% DEPTH DRILLED HITO ROCK 4.0 MATURE OF IMPRETOR TOTAL DEPTH OF HOLE R.R.A 41.5 REMARKS
(Drilling time, water loss
weathering, etc., if elg CLASSIFICATION OF MATERIALS ELEVATION DEPTH LEGEN 41.5 80.0 ENG FORM 18 36 PREVIOUS EDITIONS ARE DESOLETE. PROJECT

| | | | | | | | Hole N | la. 8 A - 88 | _ | | |
|-------------|------------|-------------|--|------------|-----------------------|-------------------|-----------------|---|----------|--|--|
| Dett | LING LO | _ | SOUTHWESTERN | HISTALL | WORT | ———— ч | | SHEET 1 | | | |
| I. PROJECT | | | SOUTHWESTERN | | | | 8"AIGER | OF 1 SHEETS | 4 | | |
| GENERA | L DYN | AMICS | | II. DAY | UN POR EL | EVATION | SHOWN (1984 AF) | 4 (1) | ┥ | | |
| L LOCATION | 4 (Courdin | ates or St. | erica) | – | | | | | | | |
| PALUXY | AQUI | FER I | NVESTIGATION | 12. MAN | UFACTUR | R'S DESI | GHATION OF DRIL | L.L. | 7 | | |
| USCE | AGENCY | | | <u> </u> | | | NG 1500 | : UNDISTURBED | } | | |
| 4 HOLE NO. | (As show | | ing title | 13. TOTA | al No. OF Den Samp | OVER- LES TAKE | DISTURBED 11 | 0 | 1 | | |
| | | | 8A -88 | ├── | | | | <u>. ; </u> | ┪ | | |
| S. HAME OF | - | | | | VATION G | | | | - | | |
| BREWE | R | | | 18. 46.4 | | | | I COMPLETED | ⊣ | | |
| | | | | 16. DAT | E HOLE | | /1/86 | 2/1/86 | 1 | | |
| A VERTI | 6 AL | METIMED | DEG. PROM VERT. | | VATION TO | | | 5/.0 | ┥. | | |
| 7. THICKNES | 15 OF OVE | ROURDE | N 19.5 | | | | —— <u> </u> | 37.0 | _ | | |
| S. DEPTH DE | HLLED IN | ITO ROCK | 0.0 | | ATURE OF | | Y FOR BORING | | 4 | | |
| S. TOTAL DE | EPTH OF | HOLE | 19.5 | 1.51 5.55 | | R. Aud | | | - | | |
| | T - 1 | | | LS | | | RE | MARKS | ┪. | | |
| ELEVATION | | LEGEND | CLASSIFICATION OF MATERIA (Decertificate) | | RECOV- | SAMPLE NO. | (Drilling time, | mater loss, depth of its., if eignificant | | | |
| <u> </u> | - | <u>-</u> - | | | • | <u> </u> | | 1 | - | | |
| 1 | 0.0 | 1 | 0.0 to 0.3, Aspha | lt | ŀ | | ** | | E | | |
| ł i |] = | | 0.3 to 3.5± | | l | A | 1) No f | ree water | E | | |
| | - | | | | [| " | | red to top | F | | |
| | | | CIAY, medium | | ł | | | ry. Boring | F | | |
| } . | = | | plasticity, stift | • | ļ | ├ ── | | 17.0 after | : E | | |
|] | -7 | | moist, brown. | | l | | completi | | F | | |
|] | | | 2 4 - 4 -+ | | | 8 | | • | F | | |
|] | l ⊐ | | 3.5 to 6.5 ² | | l | 0 | | | E | | |
| 1 1 | -7 | | CLAY, medium to h | nigh | | L. | | | F | | |
|] [| | | plasticity, stiff | | | | | | F | | |
|] | ∣ ⊐ | | moist, rust to b | | | С | 21 7455 | | F | | |
|] | | | | | | | 2) <u>JARS</u> | • | \vdash | | |
| | 7 | | 6.5 to 8.0 [±] | | | P | A) 0.0 | | F | | |
| | \neg | | CLAY, medium to | i an | | E | B) 3.5 | | F | | |
| | 10.0 | | plasticity, stif | | | L | C) 6.5 | | | | |
| 1 | | | moist. calcareous | | | _ | D) 8.0 | | F | | |
| 1 | | | tan. | ' ' | | F | E) 9.0 | | F | | |
| 1 1 | | | odii. | | | | | 5-12.5 | \vdash | | |
| 1 1 | | | 8.0 to 9.0± | | | | | 5-15.0 | \perp | | |
| 1 1 | - 7 | | | | | 6 | | 0-16.0 | F | | |
| 1 | コ | | SAND, fine to com | rse | | | | 0-18.0 | | | |
| 1 | ╛ | | grained, loose, | | • | <u> </u> | J) 18. | 0-19.5 | ь | | |
| i i | | · . | clayey, gravelly | | ٠ . | _ <i>H</i> | | | F | | |
| | \neg | ł | calcareous, brown | 1. | | | | | F | | |
| l i | コ | 1 | • | | | 1 | | | E | | |
| l . | ᅼ | | 0.0.4 | ļ | | | | | \vdash | | |
| ! | - 1 | ļ | 9.0 to 10.5 | - 1 | | 7 | 3) DRILL | ING | F | | |
| i 1 | 7 | 1 | SAND, fine to co | rse | | | | 19.5.8" | F | | |
| | 20.0 | Γ | grained, loose, | | • | | | refusal at | 上 | | |
| , i | ⇉ | | calcareous, tan. | | | | | 'limestone | | | |
| ! | 1 | - { | _ | | | | -41100 | scraping or | , L | | |
| | ᄀ | [| 10.5 to 12.5 [±] | | | | primary | . Fragment | sÉ | | |
| 1 | コ | 1 | SAND, coarse gra | ined. | | | of prim | mary materia | ã٤ | | |
| | Ⅎ | ì | loose, moist, cla | | | | on stir | nger. | F | | |
| | | į | gravelly, brown. | · · · ' | | | | -5 | 尸 | | |
| | コ | Ţ | • | | | | | | F | | |
| | ⊐ | 1 | 12.5 to 14.5 [±] | ļ | | | | | | | |
| | | i | | ايمما | | | | | F | | |
| 1 1 | لسطسا | l | GRAVEL, fine gra | | | | | | F | | |
| l j | ⇉ | Ī | loose, moist, cla | | • | | | | F | | |
| | 크 | I | brown. | -J = J • | | | | | | | |
| | | 1 | OT OMITS | | | | | | F | | |
| | コ | ļ | 14.5 to 16.0 [±] | ŀ | | | | | F | | |
| 3 | ٠٠٩ | l | | [| | | | | | | |
| | Ⅎ | l | CLAY, low plastic | cıty, | | | | | F | | |
| | 7 | 1 | soft, moist, gra | veTTA | • | | | | F | | |
| } | 7 | 1 | sandy, brown. | ļ | | | | | \vdash | | |
| | コ | l | 4/ 4 | ļ | | | | | E | | |
| | | ļ | 16.0 to 18.0 | | | | | | F | | |
| j j | \exists | į | CLAY, low plastic | city. | | | | | F | | |
| | コ |] | soft, moist, san | . v. | | | | | E | | |
| | | | rust to brown. | ~ ' | | | | | F | | |
| 1 | コ | | | | | , | | | F | | |
| ĺ | luutuu | i | 18.0 to 19.5 | _, ! | , 1 | | | | F | | |
| | ⅎ | 1 | GRAVEL, coarse gr | | | | | | | | |
| 1 1 | 7 | 1 | angular, loose, | | • | | | | F | | |
| [\ | . = | ļ | calcareous, clay | ву. | | | | | F | | |
| | 40.01 | 1 | tan to brown. | | | نا | | | 上 | | |
| ENG FORM | 1836 | PREVIOU | S EDITIONS ARE OSSOLETE. | | PROJECT | | | HOLE NO. | | | |
| /i | | | | | | | | | | | |

Hole No. 8A -88 BYALLAMOR SOUTHWESTERN OF 2 SHEETS DRILLING LOG FORT WORTH

10. SAZE AND TYPE OF SATS "AUGER

11. DAYUN FOR ELEVATION SHOWN (TEMPORAL PROPERTY OF SALES AND THE PROPERTY O HOJECT GENERAL DYNAMICS LOCATION (Carting Figure) PALUXY AQUIFER INVESTIGATION 12. MANUFACTURER'S DESIGNATION OF DRILL PAILING 1500 USCE HO. (As alsown an drawing rittle and Mic remine) BURDEN SAMPLES TAKEN ō 11 88-A8 14. TOTAL NUMBER CORE BOXES IS ELEVATION GROUND WATER BREWER 2/1/86 2/1/86 MERTICAL MINCLINED 17. ELEVATION TOP OF HOLE 7. THICKNESS OF OVERSURDEN 19.5 IS. TOTAL CORE RECOVERY FOR SORING 19. SIGNATURE OF INSPECTOR DEPTH DRILLED INTO ROCK 0.0 TOTAL DEPTH OF HOLE <u> 19.5</u> REMARKS
(Drilling time, water loos, wanthering, etc., if aigns COME BOX OR RECOVERAMPLE ERY HO. CLAMIFICATION OF MATERIALS LEGEND ELEVATION DEPTH 40.0 19.5 LIMESTONE, (auger refusal on limestone) T.D.-19.5 70.0 <u>80.</u>0-ENG FORM 18 36 PREVIOUS EDITIONS ARE OBSOLETE.

Hele No. 8A -89 DEILLING LOG SOUTHWESTERN FORT WORTH ---10. SIZE AND TYPE OF BIT GENERAL DYNAMICS PALUXY AQUIFER INVESTIGATION 12 MANUFACTURER'S DESIGNATION OF ORILL S. DRILLING AGENCY PAILING 1500 USCE 13. TOTAL HO. OF OVER-L. HOLE HO. (As also on an absorbed title 11 8A-89 14. TOTAL NUMBER CORE BOXES BREWER IS ELEVATION GROUND WATER 2/2/86 TVERTICAL MINCLINED 17. ELEVATION TOP OF HOLE -- 649.35 46.0 7. THICKHESS OF OVERBURDEN 18. TOTAL CORE RECOVERY FOR BORING --B. DEPTH DRILLED INTO ROCK 19. SIGNATURE OF INSPECTOR TOTAL DEPTH OF HOLE 46.0 S CORE BOX OR RECOV- SAMPLE ERY NO. REMARKS CLASSIFICATION OF MATERIALS ELEVATION DEPTH LEGEND (Drilling time, water love, depth of weathering, etc., if eignificant) 0.0 0.0 to 0.2, Asphalt 1) Free water <u>to 3.0</u>± encountered @34.0' Α below grade. 24 hours CLAY, medium to high later free.water. plasticity, stiff, level stabilized moist, brown. В @ 31.0ft. below grade. 3.0 to 5.0 ± CLAY, high plasticity, stiff to hard, moist, c reddish-brown. 5.0 to 14.0± CLAY, low to medium plasticity, soft, 2) JARS moist, sandy, A) 0.0-3.0 D calcareous, tan. 3.0-5.0 B) 5.0-10.0 C) 14.0 to 24.5 (ם 10.0-14.0 GRAVEL, fine to coarse grained, rounded to E) 14.0-15.0 E F) 15.0-20.0 20.0-24.5 subrounded, loose, G) moist, very clayey, tan to brown. H) 24.5-30.0 I) 30.0-32.0 J) 32.0-34.5 F 34.5-40.0 40.0-46.0 K) 24.5 to 32.0 ± CLAY, low plasticity, soft, moist, gravelly tan. G 32.0 to 34.5+ 3) DRILLING 0.0 - 46.0, 8" Auger refusal at SAND, fine to coarse grained, loose, dry, clayey, gravelly, tan top of limestone. - Auger scraping on top of primar, to brown. Fragments of prinary H 34.5 to 46.0 on stinger. GRAVEL, fine to coars Remarks: ground water grained, angular to sample obtained for subangular, dense, laboratory analysis. wet, clayey, sandy, tan to brown. 46.Q J LIMESTONE (auger refusal on limestone) ĸ ENG FORM 18 36 PREVIOUS EDITIONS ARE OSSOLETE. PROJECT

SHEET 2 SHEETS METALLATION DRILLING LOG SOUTHWESTERN FORT WORTH ROJECT 16. SIZE AND TYPE OF BIT 8 "AUGER DYNAMICS PALUXY AQUIPER INVESTIGATION
ORTHUM AGENCY
USCE PAILING 1500 HOLE NO. (As about on de UNDISTURBED BURDEN SAMPLES TAKEN 0 8A-89 14. TOTAL NUMBER CORE BOXES IL ELEVATION GROUND WATER ** 2/2/86 2/2/86 TVERTICAL | INCLINED 17. ELEVATION TOP OF HOLE THICKNESS OF OVERBURDEN 46.0 IS. TOTAL CORE RECOVERY FOR SORING DEPTH DRILLED INTO ROCK 0.0 TOTAL DEPTH OF HOLE 46.0 REMARKS
(Drilling time, motor loce, measuring, etc., if eign BOX OR SAMPLE NO. RECOV-CLASSIFICATION OF MATERIALS (Poseription) ELEVATION DEPTH LEGEND 40.0 L T.D.-46.0' 8 8 mlmhindinnlinninninninninninninninninni 80.0 PROJECT ENG FORM 18 36 PREVIOUS EDITIONS ARE OSSOLETE.

Hole No. 8A -90

| | | | | | | | Hole No. | | |
|----------|------------------|-------------|--|----------|-----------|-------------------------|---------------------|--------------------------|-------------------|
| DOLL | ING LO | | VISION | INSTALL | | | | SHEET | • |
| PROJECT | | | SOUTHWESTERN | | WORT | | 8 "AUGER | OF 1 | SHEETS |
| GENERA | L DYN | | | TI. BAT | JE POR EI | EVATION | SHOWN (THE & MEL | , | |
| LOCATION | | | | | | | | | |
| DRILLING | | FER I | NVESTIGATION | IZ MANG | | | G 1500 | | - |
| USCE | | | | 13. 707/ | | | | UNDIST | TUR SED |
| HOLE NO. | (As also | | Ma Hide | DUR | AL NO. OF | LÉS TAKE | 12 | | |
| HAME OF | DRILLER | | 8A -90 | 14. TOT | AL NUMBE | A CORE | OXES | | |
| BREWE | _ | | | IS ELEV | VATION G | HOUND WA | TER | | |
| DIRECTIO | H OF HOL | | | IS. DATE | E HOLE | | /- /a/ | DAP LET | |
| A VERTIC | EAL | HCLINED | DES. PROM VERT. | | | | | 2/4/8 | |
| THICKNES | S OF OVE | ROURDER | 39.0 | | VATION TO | | | 18.7 | 74 |
| DEPTH DR | ILLED IN | TO ROCK | | | ATURE OF | | Y FOR BORING | | |
| TOTAL DE | PTH OF | +OLE | 39.0 | 1 | | R.R.A. | Zette | | |
| | | | | | | | | RKS | |
| HOITAVE. | DEPTH | | CLASSIFICATION OF MATERIA (Description) | | RECOV- | BOX OR SAMPLE NO. | (Drilling time, und | er loon, d if elemiti | ingsh of inans |
| | 0.0 | | 0.0 1.0 2 4.000 | 1+ | - | - ' - | | | |
| | ~.'` ` | ł | 0.0 to 0.3. Aspha | .16 | l | | 1) During | | |
| ŀ | コ | ļ | 0. to 3.5^{-1} | | ĺ | Α | free water | enc | ounte: |
| Ì | ⇉ | j | CLAY, medium to h | igh | l | " | @ 24.0ft. | | |
| 1 | ⇉ | i | plasticity, stiff | , | | | grade. 24 | | |
| ļ | | ŀ | moist, brown to b | lack | ĺ | 0 | static was | | |
| l | 3 | - } | 2 4 - 5 2 + | | Í | B | taped at 2 | - | |
| 1 | 3 | | 3.5 to 7.0± | | | | below gra | de. | |
| ł | ㅋ | } | CLAY, medium to h | igh | | С | | | |
| ļ | 7 | Į. | plasticity, stiff | .] |) | - | | | |
| 1 | コ | Í | moist, brown to ru | ust. | | ((| | | |
| 1 | ᆿ | 1 | 7.0 to 18.5± | ſ | | ם | | | |
| ļ | コ | | | - 1 | | | 2) JARS | | |
| - [| 10.0 | 1 | CLAY, low to media | um ļ | | | | 2 6 | |
| - 1 | <u>-</u> - | ļ | plasticity, soft, | ļ | | 1 1 | A) 0.0-1 | | |
| | \exists | İ | moist, sandy, tan | . 1 | | | B) 3.5- C) 5.0- | 7.0 | |
| 1 | ㅋ | ł | 18.5 to 21.0 [±] | j | | ε | D) 7.0- | | |
| - 1 | コ | 1 | | | | - | E) 10.0 | |) |
| Į. | 7 | į | CLAY, high plastic | city | | (| F) 15.0 | -18.5 | , |
| ĺ | 7 | ł | stiff, moist, gra | | • | 1 | G) 18.5 | | |
| 1 | ⇉ | J | calcareous, brown | • | | | H) 21.0 | | |
| } | ュ | 1 | 21.0 to 39.0 | 1 | |] | 1) 25.0 | | |
| j | コ | ļ | | | | F | J) 27.0 | | |
| 1 | Ⅎ | | GRAVEL | [| , , | | K) 30.0 L) 35.0 | | |
| } | |] | 21.0 - 27.0 | - 1 | | | ٠, رر ر | <i></i> | • |
| 1 | \exists | - 1 | fine to coarse | | | | | | |
| } | 20.3 | } | grained, round | ed | | 6 | | | |
| - 1 | 20+9 | ì | to subrounded, | ļ | | | - • - | | |
| i | コ | ļ | loose, moist to | o wet | | | 3) <u>DRILLI</u> | NG | |
| j | コ |) | clayey, brown. | Ì | | i 1 | 0.0 - 3 | 9.0, | 8" |
| ĺ | コ | - 1 | 27 0 ~ 30 0 | 1 | | н | auger re | fusal | at |
| - 1 | Ⅎ | - (| 27.0 ¥ 39.0 | | | " | top of 1 | | |
| J | | 1 | fine to coarse | | | | -Auger s | | |
| 1 | 3 | [| grained, angula | ar | | | primary. | Frag | ments |
| 1 | _7 | - 1 | to subangular. | ì | Ì | , | of limest | one; c | n |
| | \exists | - 1 | cobbles throug | | | ' | stinger. | | |
| - 1 | ヸ | - (| dense, wet, ta | | ļ | | Remarks: g | | |
| - 1 | コ | - 1 | | İ | | _ | sample obt | | |
| ſ | コ | | 39.0 | J | | 5 | laboratory | ana. | rysis |
| 1 | | - | LIMESTONE, (auger | 1 | 1 | | | | |
| J | 30 +9 | | refusal on limest | one) | | | | | |
| - 1 | Ⅎ | - 1 | | - 1 | | | | | |
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| 1 | \exists | ŀ | T.D39.0' | ŀ | | K | | | |
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| ļ | 40. 5 | | | | ŀ | ——- | | | |

| | | | | | | | | Hel | e Ne. | 8 A-91 | |
|----------------|--------------|--------|-----------|--|---|-------------------------|--------|----------------|-------------|--|----------------------|
| Dett | LING LO | YG | DIVISION | | INSTALL | | | | | SHEET 1 | \Box |
| I. PROJECT | | - 1 | SOUTH | WESTERN | | WORT | | SMATICED | _ | OF 1 SHEE | |
| GENER | AL DY | | | | 10. SIZE AND TYPE OF BIT 8 "AUGER 11. DAYUM FOR ELEVATION SHOWN (TEM _ MEL) | | | | | | |
| E LOCATION | | | | MTG4 MTON | | | | IGNATION OF | | | |
| 3. DRILLING | AGENCY | r r.R | THARES | TICATION | '& WANL | r ag i URE | | LING 1500 |) | | |
| USCE | /A | | -taa Hela | · · · · · · · · · · · · · · · · · · · | 12. TOT/ | L NO. OF | | | 0 | UNDISTURBE | • |
| - M- M- | | | | 8 A-91 | | AL HUMPE | | ` | | <u> </u> | \dashv |
| & NAME OF | | 1 | | | | ATION GE | | | * | | \dashv |
| BREWE | R W OF HO | LE | | | + | | 187 | ARTED | | DMPLETED | ┥. |
| Æ YERTI | | | | 0E6. FROM VERT. | | | | /4/86 | | 1/4/86 | - |
| 7. THICKNES | S OF OV | ERBURO | EH | 31.5 | | VATION TO | | | | 47.21 | |
| e. DEPTH OF | | | | 0.0 | | AL CORE P | | TOR | 3 | <u> </u> | -1 |
| S. TOTAL DI | EPTH OF | HOLE | | 31.5 | 1 | R | R.A. | detta | | | _ |
| ELEVATION | DEPTH | LEGEN | 9 | LASSIFICATION OF MATERI (Description) | ALS | S CORE RECOV- ERY | BOX OF | E (Drilling to | REMA | RKS or lose, depth of , if eigniticand | , |
| • | | | <u> </u> | 4 | | ERY | MG. | | * *** | , If eigniticent | \bot |
| | 0.0 | 1 | Το. | 0 to 0.3 | | | 1 | 1) No | free | e water | E |
| |) = | } | - | PHALT, good con | ditio | | | | | ed to to | , † |
| | _ | } | 1 23 | FIREIT, ECOC CO. | | Ţ | | | | y. Borina | |
| | = | 1 | 1 ^ | 3 to 3.0 [±] | | | | taped | to | iepth-dry | /• إ |
| ļ | _= | 1 | | | 1b | } | | | | | F |
| I | = | ‡ | ဌ | AY, medium to hasticity, stiff | ızgn | | visu | ı a 1 | | | F |
| 1 | = | 1 | m o | ist, brown to b | lack. | | ider | - | | | F |
| | = | ‡ | | | | l | | | | | F |
| Ì |] = | 1 | 1 3. | 0 to 9.5± | | } | |] | | | F |
| 1 | _ | 1 | | AY, low to medi | | 1 | | 1 | | | E |
| | = | 1 | ; | asticity, soft, | um | | | 2) <u>JA</u> | | | Е |
| i | 10.0 | 1 | | ist, brown. | ' | | i | visu | al | identifi | ca t [_c |
| l | 10.0 | 3 | 1 | | | | 1 1 | | | | E |
| ! |] = | 3 | 9. | 5 to 26.5 | | <u> </u> | | | | | E |
| \$ | l — | } | | AY, low to medi | um | \ | 1 | | | | ┢ |
| |] = | 1 | رَمَ ا | asticity, soft, | , | | | | | | |
| | l _ | ‡ | | ist, sandy with | | ł | | | | | F |
| , |] = | ‡ | | rominent sand se | | | | 3) <u>DF</u> | RILL | ING | F |
| i ' | = | 1 | be | 4.0-15.5, 18.0- coming increasi | ngly | 1 | 1 1 | | | 1.5, 8" | F |
| 1 | | 1 | CS | lcareous below | 24.0 | ľ | 1 | Auge | י די | efusal a | ŧF |
| i | = | 1 | | th calcium cart | | ! | | top | of | primary. | - ⊢ |
| | - | 7 | | ebs and seams i ection. tan. | ın | | | -Aue | ger s | craping | on |
| | = | 3 | " | coton, can | | } | 1 1 | | | l imaş tone ts of pr | |
| | 20.0 | 3 | 26 | 5.5 to 31.5 | | | | | • | ger. | -**E |
| | 20.0 | 1 | _ | | | • | | " | , , | 6 | · E |
| | - | 1 | | AY, high plastitiff, moist, cal | LCITY, | 10 | { | ł | | | E |
| | | 1 | | th numerous cal | | ſ | | 1 | | | ⊢ |
| | = | ‡ | CE | rbonate seams a | ind | ļ | | | | | F |
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| | = | 1 | to | gray to rust. | | , | | | | | F |
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| | = | 1 | | 1.5 | | | | 1 | | | F |
| | = | 3 | | IMESTONE, (auger | | 1 | | | | | F |
| 1 | | 3 | r | efusal on limes | tone) | <u> </u> | | 1 | | | E |
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| l | 30 :0 | 1 | | T.D31.5' | | | iden | | | | E |
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| | 40.0 | 1 | | | | | ┸、 | | | | F |
| ENG FORM | 1836 | PREV | IOUS EDI | TIONS ARE DESOLETE. | | PROJEC | T | | | HOLE NO | . |
| m~~ () | | | | | | | | | | - | |

| | | | | | _ | | Hole No. 8 | A-92 | | | |
|------------------|------------------|--------|---|---|-----------|-------------------------|--|----------------|----------|--|--|
| DELL | LING LO | 6 | OUTHWEST ERN | BOR | | v | | SHEET 1 | | | |
| I. PROJECT | | | | 10. SIZE | MORT | OF BIT | 8 "AUGER | OF T SHE | *** | | |
| GENERA: | L DYN | AMICS | 5 | II. DAT | UN FOR KI | EVATION | SHOWN (THE - MILL) | | _ | | |
| PALUXY | AQUI | FER 1 | NVESTIGATION | 12. MANUFACTURER'S DESIGNATION OF DRILL | | | | | | | |
| 1 DRILLING | AGENCY | | | L | F | AILIN | G 1500 | | | | |
| USCE | (As show | - | ing title! | 13. TOT | AL NO. OF | OVER- LES TAKE | . ; | O | 40 | | |
| | | | 8A -92 | | AL NUMBE | | <u> </u> | <u> </u> | \dashv | | |
| BREWE | | | | | VATION G | | | | \dashv | | |
| & DIRECTION | | £ | | | | 1 ST A | RTED CO | #LETED | \dashv | | |
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| 7. THICKNES | S OF OVE | REUROE | tw 22.5 | 17. ELE | VATION TO | P OF HO | LE 647.0 | <u> </u> | | | |
| a. DEPTH DR | | | | | AL CORE ! | | Y FOR BORING | | -4 | | |
| S. TOTAL DE | EPTH OF H | 10LE | 23.5 | 19. 34GN | ATURE OF | R | Audette | | | | |
| ELEVATION | DEPTH | | | us | 1 CORE | BOX OR SAMPLE NO. | DEMAR | C\$ | | | |
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| ' - | 0.0 | | • | | <u> </u> | - i - | ** | | ╼ | | |
| i | | | 0.0 to 0.3 | | | . | 1) No free | | E | | |
| 1 | | | ASPHALT, good cond | iitio | h | ! | encountered | | | | |
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| | = | | 0.3 to 2.5 [±] | | } | | | - p | ĭE | | |
| | | | | i ah | [| | | | F | | |
| | ╛ | | CLAY, medium to his plasticity, stiff | -Ru | } · | visu | | | Ë | | |
| | ╛ | | moist, brown to b | Lack. | | iden | t. | | E | | |
|) i | | | | | J |] , | | | E | | |
| | ⇉ | | 2.5 to 5.5± | | | | 2) JARS | | F | | |
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| | ⊣ | | CLAY, low plastic soft, moist, very | Lty, | | | 113001 10 | , | ~ ĭĔ | | |
| | 10.0 | | gravelly throughou | ıt. | | | | · | E | | |
| 1 | \exists | | calcareous, tan. | - | | | | | E | | |
| i i | | | | | | ! | | | ᆮ | | |
| l | コ | | 5.5 to 16.5 [±] | | | | | | ⊨ | | |
| 1 | = | | CLAY, low to media | 100 | | | 3) <u>DRILLIN</u> | <u> </u> | F | | |
| j | ーゴ | | plasticity, soft, | | | | 0.0 - 22. | 5, 8" | E | | |
| | ╡ | | moist, sandy, | | : | | Auger ref | | | | |
| 1 } | • 🗆 | | calcareous, tan. | | |]]] | top of lin | nestone | · _ | | |
| , | ョ | | | | | 1 | primary. l -A_ger ad | m noed | ⊨ | | |
| | 7 | | 16.5 to 22.5 | | | visua ident | | | of | | |
| | 7 | | CLAY, medium plas | ticit | | | fragments | of pri | mary | | |
| [| ⊣ | j | stiff, moist, | | | 1 | on stinger | r. | ⊨ | | |
| | J | į | gravelly, calcare | | | | Note: Bori | ng offs | set⊨ | | |
| | 20.허 | | with calcium carbo nodules and blebs | nate | | | approximat | ely 10' | ' .F | | |
| 1 | \exists | | in section, brown | to | | | east of ta | | a tre | | |
| | \dashv | | tan. | | : | | due to tra | | F | | |
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| | 3 | | LIMESTONE, light fine grained, sof | ŧ. 1 | | | | | F | | |
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Hole No. SA-93 TARLES OF DOILLING LOG FORT WORTH SOUTHWESTERN OF1 SHEETS M. MIZE AND TYPE OF MITS "AUGER GENERAL DYNAMICS PALUXY AQUIPER INVESTIGATION IZ MANUFACTURER'S DEMONATION OF BOILS FAILING 1500 USCE HOLE NO. (As shown as desiring tell 12 TOTAL NO. OF OVER-0 8A-93 14. TOTAL HUMBER CORE BOXES IS ELEVATION SHOUND WATER BREWER TOVERTICAL DINCLINED 2/5/86 2/5/86 17. LEVATION TOP OF HOLE -- 650.96 7. THICKNESS OF OVERSUSDEN 39.0 M. TOTAL CORE RECOVERY FOR BORING L DEPTH DRILLED HITO ROCK 0.0 TOTAL DEPTH OF HOLE 39.0 NECOVE SAMPLE CLASSIFICATION OF MATERIALS REMARKS ELEVATION DEPTH LEGEM 0.0 1) Free water level 0.0 to 0.3 taped at 29.2ft. Asphalt, good condition below grade. Static water level 0.3 to 1.5 ± taped at 27.0ft. risua CLAY, medium to high ident below grade. plasticity, stiff, moist, brown to black. 1.5 to 6.0[±] CLAY, high plasticity, stiff, moist, reddish-brown. 2) JARS visual identification 6.0 to 11.0± CLAY, low plasticity, soft, moist, very sandy throughout, calcareous, tan. ident. 3) DRILLING 0.0 - 39.0, 8" 11.0 to 29.2[±] Auger refusal at CLAY, medium to high top of limestone plasticity, stiff, primary. Auger moist, alightly scraping on top of gravelly, calcareous with calcium carbonate 20.0 primary with fragments of primary on stinger blebs and nodules in section, brown to tan NoteA)Boring offset approximately 20' to rust. sort: of taped location due to 29.2 to 39.0 traffic conditions. GRAVEL, fine to coarse grained, angulat to B) ground water sample subrounded, loose, obtained for laboratery wet, clayey, sandy, tan to brown. analysis. 39.0 visuall LIMESTONE, (auger lidenti. refusal on limestone) T.D.-39.0' 40.0 ING PORM 1836 PREVIOUS EDITIONS ARE OSSOLETE.

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| L LOCATION | Courte | T P P P | INVESTIGATION | <u> </u> | | | | | | | |
| 3. DRILLING | AGENCY | TEEK | IN EDITORITON | 12. MANUFACTURER'S DESIGNATION OF BRILL PAILING 1500 | | | | | | | |
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| 4. HOLE NO. | (As show | - | ng title | - 606 | AL NO. OF | LES TAKE | 0 | 0 | | | |
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| 6. DIRECTIO | H OF HOL | | | <u> </u> | | | ATED COMPL | | | | |
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| 7. THICKNES | | | | 10. TOT | AL CORE | RECOVER | Y FOR BORING | • | | | |
| S. DEPTH DE | | | | 19. SIGN | ATURE OF | INSPECT | · 09 14 | | | | |
| 9. TOTAL DE | EPTH OF | HOLE | 20.0 | L | | K.K.A. | dette | | | | |
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| | 7 | | ASPHALT, good cond | ition | 1 | 1 1 | augering. Bo | | | | |
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| [| ı ∃ | | CLAY, medium to hi | æh | l | | | F | | | |
| 1 |] | | plasticity, stiff, | p., | 1 | 1 1 | | F | | | |
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| 1 1 | 7 | | CLAY, low plastici | ty, | 1 | ١. | | F | | | |
| ł i | 10.4 | | soft, moist, sandy | | | 1 1 | 2) JARS | = | | | |
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| { | コ | [| CLAY-SHALE, tan to | | | | 0.0 - 20.0, | | | | |
| Į 1 | コ | ĺ | greenish-gray, calcareous, soft. | | | | refusal at t | op of E | | | |
| 1 | Ⅎ | ľ | AMERICAN SOLLS | | | | limestone pr | imary. | | | |
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| ACTION OF THE LESSON CLASSIFICATION OF SATERIALS STATEMENT OF THE ACTION OF SATERIALS STATEMENT OF SATERIALS SA | | | | | | | | | | . 40 | <u> </u> | | |
| CLAY, low plasticity, soft, moist, sandy throughout, tan. 9.0 to 14,5² CLAY, low to medium plasticity, soff, moist, sandy throughout, tan. 9.0 to 14,5² CLAY, low to medium plasticity, soff, moist, sandy throughout, tan. 9.0 to 14,5² CLAY, low to medium plasticity, soff, moist, sandy throughout, tan. 9.0 to 14,5² CLAY, low to medium plasticity, soff, moist, sandy throughout, tan. 9.0 to 14,5² CLAY, low to medium plasticity, soff, moist, calcareous, gravelly throughout, tan. 14.5 to 31.5² CLAY, medium to high plasticity, stiff, moist, sandy throughout, limy with many calcium carbonate seems in section, tan. 30.0 CLAY, medium to high plasticity, stiff, moist, sandy throughout, limy with many calcium carbonate seems in section, tan. 31.5 to 36.0 30.0 CLAY, medium to high plasticity, stiff, moist to wet along basal scrip, calcaraous with many lime nodules and bleeb in section, sandy espacially along basal scrip, calcaraous with many lime nodules and bleeb in section, reddish-brown. 36.0 17.D36.0' 18. CRAY Throughout | | | | | | J 19. SIGN | ATURE O | | | | | | |
| 0.0 to 0.1 ASPHALT, good condition 0.3 to 2.4* CLAY, medium to high plasticity, stiff, moist, brown. 2.4 to 6.5* CLAY, low plasticity, soft, moist, gravelly, calcereous, brown. 2.0 to 14.5* CLAY, low plasticity, soft to stiff in section, moist, calcareous, gravelly throughout, ban. 2.0 to 14.5* CLAY, low to medium plasticity, soft to stiff in section, moist, calcareous, gravelly throughout, brown. 14.5 to 31.5* CLAY, medium plasticity, stiff, moist, sandy throughout, limy with many calcium carbonate seems in section, tan. 31.5 to 36.0 CLAY, medium to high plasticity, stiff, moist, sandy spacially siong basal section, sandy spacially siong basal sone, calcareous with many lime nodules and blebs in section, reddish-brown. 16.0 LIMISTONE, (auger refusal on linestone) T.D36.0' MSFORM 1144 | ELEVATION | DEPTH | LEGEN | | LASSIFICATION OF MATERIA | 14 | S CORE | | REMA | | 1 | | |
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| O.3 to 2.4 to GLAY, medium to high plasticity, stiff, moist, brown to black calcareous, soft, moist, gravelly, calcareous, brown. 2.4 to 6.5 to 9.0 to 14.5 to 31.4 to stiff in section, moist, calcareous, gravelly throughout, brown. 20.0 to 14.5 to 31.4 to stiff, moist, sandy throughout, timp plasticity, stiff, moist, sandy throughout, brown. 14.5 to 31.4 CLAY, medium plasticity, stiff, moist, sandy throughout, limp with many calcium carbonate seams in section, tan. 31.5 to 36.0 CLAY, medium to high plasticity, stiff, moist to wet along basal section, eandy especially along basal section, eandy especially along basal scotion, reddish-brown. 16.0 LIMESTONE, (auger refusal on limestone) T.D36.0 Pages | | = | ì | Ì | SPHALT, good co | nditi | on | 1 1 | at 35.0f | | E | | |
| CLAY, medium to high plasticity, stiff moist, brown to black grade. 2,4 to 6,5 CLAY, low plasticity, soft, moist, calcareous, brown. 2.0 to 14,5 CLAY, low plasticity, soft to stiff in section, moist, calcareous, gravelly throughout, tan. 2.0 to 14,5 CLAY, medium plasticity, soft to stiff in section, moist, calcareous, gravelly throughout, brown. 14,5 to 31,5 CLAY, medium plasticity, stiff, moist, sandy throughout, limy with mray calcium carbonate seams in section, tan. 31.5 to 36.0 CLAY, medium to high plasticity, stiff, moist to wet along basal section, eardy especially along basal section, eardy especially along basal sore, calcaraous with many lime nodules and blebs in section, reddish-brown. 36.0 LIMESTONE, (auger refusal on limestone) T.D36.0' PARTY water level taped grade. ident. 2) JARS visual identification 3) DRILLING 0.0 - 36.0, 8" Auger refusal at top of limestone hauger screping on primary with fragments of limestone found on stinger. Remarks: ground water sample obtained for visual laboratory analysis ident. | | = | 1 | i | | | i | 1 1 | | ma laten | E | | |
| CLAY, low plasticity, stiff, moist, sandy throughout, tan. 2.0 to 14.5 [±] CLAY, low to medium plasticity, soft to stiff in section, moist, calcareous, moist, calcareous, prown. 2.0 to 14.5 [±] CLAY, low to medium plasticity, soft to stiff in section, moist, calcareous, gravelly throughout, brown. 14.5 to 31.5 [±] CLAY, medium plasticity, stiff, moist, sandy throughout, limy with many calcium carbonate seams in section, tan. 31.5 to 36.0 CLAY, medium to high plasticity, stiff, moist to wet along basal section, sandy especially along basal section, reddish-brown. 26.0 LINESTONE, (auger refusal on limestone) T.D36.0' PARTY PARTY At 32.5ft. below grade. Visual identification 3) DRILLING 0.0 - 36.0, 8" Auger refusal at top of limestone Auger scraping on primary with fragments of limestone found on stinger. Remarks, ground wat E sample obtained for visual laboratory analysis lident. | | - | • | 9 |).3 to 2.4 ^T | | 1 | { } | | | 上 | | |
| moist, brown to black 2.4 to 6.5 [±] CLAY, low plasticity, soft, moist, gravelly, calcareous, brown. 6.5 to 9.0 [±] CLAY, low plasticity, soft, moist, sandy throughout, tan. 9.0 to 14.5 [±] CLAY, low to medium plasticity, soft to stiff in section, moist, calcareous, gravelly throughout, brown. 14.5 to 31.5 [±] CLAY, medium plasticity, stiff, moist, sandy throughout, limy rith many calcium carbonate seams in section, tan. 31.5 to 36.0 CLAY, medium to high plasticity, stiff, moist to wet along basal section, sandy especially along basal sore, calcareous with many lime nodules and blabs in section, reddish-brown. 36.0 LIMESTONE, (auger refusal on limestone) T.D36.0' Teams Total and the black ident. | |] | ì | 2 | LAY, medium to | high | ł | | at 32.5 | | F | | |
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| CLAY, low plasticity soft, moist, gravelly calcareous, brown. 6.5 to 9.0 [±] CLAY, low plasticity soft, moist, sandy throughout, tan. 9.0 to 14.5 [±] CLAY, low to medium plasticity, soft to stiff in section, moist, calcareous, gravelly throughout, brown. 14.5 to 31.5 [±] CLAY, medium plasticity, stiff, moist, sandy throughout, limy it with many calcium carbonate seams in section, tan. 31.5 to 36.0 CLAY, medium to high plasticity, stiff, moist to wet along basal section, sandy especially along basal score, calcareous with many lime nodules and blebs in section, reddish-brown. 36.0 LIMESTONE, (auger refusal on limestone) 7.D36.0' MG FORM 1814 | | | 1 | i " | TOTAL DECAME TO | TECH | | | | | E | | |
| CLAY, low plasticity soft, moist, gravelly calcareous, brown. 6.5 to 9.0 [±] CLAY, low plasticity soft, moist, sandy throughout, tan. 9.0 to 14.5 [±] CLAY, low to medium plasticity, soft to stiff in section, moist, calcareous, gravelly throughout, brown. 14.5 to 31.5 [±] CLAY, medium plasticity, stiff, moist, sandy throughout, limy it with many calcium carbonate seams in section, tan. 31.5 to 36.0 CLAY, medium to high plasticity, stiff, moist to wet along basal section, sandy especially along basal score, calcareous with many lime nodules and blebs in section, reddish-brown. 36.0 LIMESTONE, (auger refusal on limestone) 7.D36.0' MG FORM 1814 | | = | | | 2.4 to 6.5 | | l | ١ | } | | E | | |
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| calcareous, brown. 6.5 to 9.0 CIAY, low plasticity, soft moist, sandy throughout, tan. 9.0 to 14.5 CIAY, low to medium plasticity, soft to stiff in section, moist, calcareous, gravelly throughout, brown. 14.5 to 31.4 CIAY, medium plasticity, stiff, moist, sandy throughout, limy with many calcium carbonate seams in section, tan. 31.5 to 36.0 CIAY, medium to high plasticity, stiff, moist to wet along basal section, sandy especially along basal sone, calcaraous with many lime nodules and blebs in section, reddish-brown. 36.0 LIMESTONE, (auger refusal on limestone) T.D36.0' PROFITE INDESTANCE (auger refusal on limestone) T.D36.0' PROFITE INDESTANCE (auger refusal on limestone) | | Ξ | | ا ا | oft. moist. gra | velly | | 1 1 | | | F | | |
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| A. DIRECTIO | | | | | E HOLE | | MTED IC | - |
| ₩ VERT | CAL [] | MCLIME | 059. PROM VERT. | - | | | | 2/7/86 |
| 7. THICKNES | | | | | AL CORE | | Y FOR BORING - | 50.98 |
| A. DEPTH DI | | | | | ATURE 9 | INSPECT | OR , | |
| S. TOTAL D | r — | | 35.0 | | s cone | | REMA | |
| RLEVATION | DEPTH | LEGEND | (Petertetion) | | RECOV- | SAMPLE HO. | (Driffing time, und | er loce, depth of , if significant |
| | 0.0 | <u> </u> | • | | - • - | * | 4) | |
| 1 | = | 1 | 0.0 to 0.3 | | } | | 1) No fre | _ |
| | = | | ASPHALT, good con | ditio | n | | | veral hours |
| | = | | | | l | 1 1 | | ing bridge |
|] | | | 0.3 to 4.5 [±] | |] |] | in 2 27.0 | itdry. |
| | Ξ | } | CLAY, low plastic | ity. | 1 | ł I | | F |
| | = | | soft, moist, grav | elly, | | visus | 1 | E |
| | = | | limy with nodules section, tan to b | | | ideni | • | E |
| | = | | 30001011, 0011 00 | | | l 1 | | = |
|] | | | 4.5 to 24.5± | | • | | 2) JARS | F |
| | # | | CLAY, low to medi | 1178 · | | | | ntification |
| [| 10-9 | | plasticity, soft, | | | | Visual ide | ntilleation - |
| | Ξ | | moist, sandy thro | ughou | t, | | | F |
| | | | scattered in sect | | | | | F |
| 1 | i ⊐ | | tan. | | |) } | | E |
| | | | | | ĺ | | 3) <u>DRILLI</u> | NG E |
| · | -∃ | | 24.5 to 34.0 | ļ | | | 0.0 - 35.0 | , 8"Auger |
| | 3 | | CLAY, medium to h | | | | to depth. | muzer - E |
| | ╡ | | plasticity, stiff moist, sandy, | ' | | | | nto limestar |
| | ∃ | | calcareous, reddi | sh- | | | of limesto | ith fragment ne on |
| | \exists | | brown. | | | | stinger. | ··· F |
| | . = | | | | | | | E |
| | 20-9 | | 34.0 to 35.0 | | | visua | | E |
| | = | | LIMESTONE, light | | | ident | • | = |
| ļ | -3 | ļ | fine to coarse grants | 164 | • | 1 | 1 | F |
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| ENG FORM | <u>4070</u> | | | | PROJECT | | | HOLE NO. |
| | 1536 | PREVIOU | S EDITIONS ARE DESCLETE. | l | | | | (|

(TRANSLUCENT)

Hole No. da -98 A CHEMICS DEILLING LOG PORT WORTH

9. SIZE AND TYPE OF MY 8 "AUGER

11. DATUS FOR ELEVATION SHOWN (1988 - ME) SOUTHWESTERN 7.91.74 GENERAL DYNAMICS PALUXY AQUIFER INVESTIGATION 12. MANUFACTURER'S DESIGNATION OF DRILL PAILING 1500 12. TOTAL NO. OF OVER-UNDISTURBED 8A-98 BREWER 2/7/86 2/7/86 XVERTICAL | INCLINED 17. ELEVATION TOP OF HOLE -- 643,64 7. THICKNESS OF OVERSURDEN 19. TOTAL CORE RECOVERY FOR BORING B. DEPTH ORILLED INTO ROCK 18. SIGNATURE OF INSPECTOR B. TOTAL DEPTH OF HOLE 4.5 REMARKS S CORE CLASSIFICATION OF MATERIALS ELEVATION DEPTH LEGENC 0.0 1) boring taped to visual depth-dry. 0.0 to 0.3 ASPHALT, good condition ident. 0.3 to 1.5 CLAY, low plasticity, soft, moist, gravelly, sandy, brown. 1.5 to 3.5 2) JARS LIMESTONE, light gray, fine to coarse grained arenaceous, soft. visual identificati 3.5 to 4.5 CLAY-SHALE, tan to greenish-gray, calcareous, soft. 3) DRILLING 0.0 - 4.5, 8"Auger to depth. T.D.-4.5° Remarks: Boring offset approximately 35 ft. west on line ENG FORM 18 36 PREVIOUS EDITIONS ARE OSSOLETE.

| | | | | | | | Hole No. | 8 A- 99 |
|-------------|------------------|---------|------------------------------------|---------|-----------|-------------------------|-------------------|---------------------------------------|
| DRIL | LING LO | 6 ° | SOUTHWESTERN | RODE | WORT | . — | | OF 1 SHEETS |
| I. PROJECT | | | | | | | 8 "AUGER | |
| GENERA | L DYN | AMICS | <u> </u> | 11. BAY | UE FOR E | LEVATION | SHOWN (THE - NEED | 3 |
| PALUX | Y AQU | IPER | INVESTIGATION | 12 MAN | UFACTUR | TO SERVE | MATION OF DRILL | |
| IT DAMPLING | ASENCY | | | | | AILING | 1500 | |
| USCE | (As show | | be title | 13. TOT | AL NO. OF | OVER- | DISTURBED | UNDISTURBED |
| | | | 8 A - 99 | | | R CORE S | <u> </u> | . 0 |
| BREWER | | | | | | ROUND WA | | - |
| S. DIRECTIO | | | | | E HOLE | BTA | | OWFLETED |
| Z VERTI | CAL | MCLIMED | DES. FROM VERT. | | | | 7/86 2 | /7/86 |
| 7. THICKNES | S OF OVE | REVROE | n 2,5 | | | OP OF HO | | 4.98 |
| B. DEPTH OF | HLLED IN | TO ROCK | | | ATIME OF | | ^~ | |
| S. TOTAL DE | EPTH OF 1 | HOLE | 4.0 | | | R.A. | dette | |
| ELEVATION | DEPTH | LEGENO | CLASSIFICATION OF MATERIA | 3 | | SOX OR SAMPLE NO. | REMA | |
| | | | (Description | | ERY | HO. | medianing of | er lose, depth of . If elgrificant |
| | 0.0 | | | | | 1 | | |
| 1 | 7 | | 0.0 to 0.4 | | | visus | 11) Boring | taped to |
| 1 | - | | | | L | iden | depth-dr | λ. ‡ |
| 1 | 7 | | ASPHALT, good con | u1610 | ľ' | | | ; |
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| 1 | l I | | 0.4 to 2.5 | |] | | | † |
| | 1 3 | | CLAY, low plastic | ity. | 1 | | | |
| | I∃ | | soft, moist, grav sandy, brown. | атту. | 1 | | | ļ |
|] | ⊢∃ | - 1 | Smith? OF OAll! | | | i I | | 1 |
| | <u>-</u> | l | 2.5 to 4.0 | | 1 |] | 2) <u>JARS</u> | ļ |
| | = | 1 | | | ŀ | | visual ide | ntificatio |
| | \exists | i | LIMESTONE, light fine to coarse gr | gray. | | ŀi | | |
| | 10.0 | | soft. | riveo | • | | | E |
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|]] | | | T.D4.0° | | | 1 | 2) DD#### | ,, E |
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| ING FORM | 1836 P | REVIOUS | EDITIONS ARE OFFICE . | \neg | PROJECT | | | HOLE NO. |

TRANSLUCENTS

Hele No._8A4C-100 1.71UUA.75 ----DOLLING LOS SOUTHWESTERN FORT WORTH OF 1 SHEETS 11. BAYLE FOR ELEVATION BROWN (THE ... CORE GENERAL DYNAMICS PALUXY AQUIFER INVESTIGATION 12. MARKET ACTUMENTS OF BANKET AT BANKET PAILING 1500 USCE HOLE NO. (As above on a ٥ 8A4C-100 IA TOTAL HUMBER CORE BOXES HAME OF BRILLER IS ELEVATION COOKING TATES 44 BREWER 2/8/86 2/9/86 DEVERTICAL TIMELIMED 17. ELEVATION TOP OF HOLE -- 647. 10 7. THICKNESS OF OVERSUROEN 480 M. TOTAL CORE RECOVERY FOR BORING DEPTH DRILLED HITO ROCK R.R. Augette 4.0 52.0 S CORE SAMPLE CLASSIFICATION OF MATERIALS DEMARKS (Drilling time, omice face, depth of 0.0 1) During augering 0.0 to 0.4 free water taped @ 33.0ft. below ASPHALT, good condition grade. 2hours later 0.4 to 4.0± static water level CLAY, low plasticity, soft, moist, gravelly, limy with nodules taped # 32.0ft. below grade. visual in section, tan to ident. brown. 4.0 to 33.5 10.0 2) JARS CLAY. low to medium plasticity, soft to visual identificatio stiff in zones, sandy throughout, small limy nodules scattered in section, tan. 33.5 to 48.0 3) DRILLING GRAVEL, fine to coarse 0.0 - 48.0, 8 auger refusal at top of grained, angular to subrounded, loose, wet, clean, tan. limestone primary. 48.0 - 52.0, 4"core to depth. 0.0 48.0 to 52.0 LIMESTONE, gray, fine to coarse A) ground mater sample grained, argillaceous obtained for laboratory with shale stringers analysis. and thin seams in B) Casing advanced top of primary and visual reamed. section, weathered, soft. ident C) After coring boring bailed. 4". T.D.-52.0' PVC pipe inserted to depth.Hole grouted through PVC insert 30 40 with PVC being slowly withdrawn during grouting. D) Boring subsequen Ly backfilled with cuttings. E) Boring offset approximately 7.0ft southwest. 40.Œ

DRILLING LOG PORT WORTH

D. SIZE AND TYPE OF BITS "A UGER, 4"CORE
TI. DATUS FOR ELEVATION SHOWN (1985 & MEC) SOUTHWESTERN OF 2 SHEETS BOJECT 12. MANUPACTURER'S DESIGNATION OF ORICL.
PAILING 1500
13. TOTAL MG. OF OVER- | DESTURBED 12. TOTAL NO. OF OVER-0 8A4C-100 BER CORE BOXES IL ELEVATION GROUND WATER 2/9/86 2/8/86 TO VERTICAL | INCL 17. ELEVATION TOP OF HOLE 48.0 4.0 . THICKNESS OF OVERSURDEN IS. TOTAL CORE RECOVERY FOR BORING DEPTH DRILLED INTO ROCK R. A. 52.0 TOTAL DEPTH OF HOLE BOX OR SAMPLE S CORE CLASSIFICATION OF MATERIALS DEPTH LEGEND 48-0 40 1 520 80.0 ENG FORM 1836 PREVIOUS EDITIONS ARE OSSOLETE.

(TRANSLUCENT)

Hole No. 3A4C-101 THE WAR SHEET DRILLING LOG SOUTHWESTERN FORT WORTH OF 2 SHEETS PARET 11. DAYON FOR ELEVATION SHOWS COM GENERAL DYNAMICS PALUXY AQUIPER INVESTIGATION LOCATION /C 12. MANUFACTURER'S DESIGNATION OF DRILL PAILING 1500 USCE HOLE NO. (As about an drawing title and the manhor) 11. TOTAL NO. OF OVER- DISTURGED BURDEN SAMPLES TAKEN UNDISTURBED 8A4C-101 14. TOTAL HUMBER CORE BOXES MAME OF DRILLER 18. ELEVATION GROUND WATER BREWER 2/11/86 IL DATE HOLE TYERTICAL | INCLINED ---2/11/86 --648.35 17. ELEVATION TOP OF HOLE 47.5 4.0 7. THICKNESS OF OVERBURDEN 18. TOTAL CORE RECOVERY FOR SORING 77.0% B. DEPTH DRILLED INTO BOCK 19. SIGNATURE OF INSPECTOR B. TOTAL DEPTH OF HOLE 51.5 S CORE BOX OR SAMPLE NO. REMARKS
(Drilling time, meter loce, meeting, etc., if sign CLASSIFICATION OF MATERIALS (Posseription) ELEVATION DEPTH LEGEND 4 0.0 to 0.5 1) During augering free water encountered ASPHALT, good condition at 34.0ft. below 0.2 to 1.2 to grade. SAND, fine to coarse -Static water level taped at 30.5ft bel w gr ined, loose, dry, gravelly, clayey, grade. brown. visual 1.2 to 4.0[±] ident. CLAY, medium to high plasticity, stiff, moist, brown to black. 2) JARS visual identification 4.0 to 21.0 ± CLAY, low to medium plasticity, soft, to stiff in zones, moist, becoming increasingly sandy below 12.0° to depth. calcareous with limy nodules and blebs 3) DRILLING noted along basal 0.0 = 47.5, 8"auger refusal at top of section, tan. 21.0 to 23.0± limestone primary. GRAVEL, fine to coarse 47.5 - 51.5. 4"core grained, subrounded to rounded, loose, dry, clayey, sandy, tan. to depth. Remarks: isua ident.A) casing advanced 23.0 to 35.0± top of primary and reamed. CLAY, low plasticity, soft, moist, calcareous, B) After coring, hote bailed repeatedly until nearly dry. One 94 lb. bag of cemen tan. 35.0 to 44.5± used to grout hole. CLAY, medium to high plasticity, stiff, wet calcareous with limy Grout extended to 40.0ft. datum below 30.0 grade. seams and nodules throughout, sandy, C) Boring subsequently backfilled with cuttings. reddish-brown. D) ground water sample 44.5 to 47.5 obtained for labora ery GRAVEL, coarse grained, rounded to subrounded, analysis. loose, wet, clayey, brown. 40.7 HOLE NO.

Hole No.8A4C-101 STALLATION DRILLING LOG FORT WORTH

11. DATUS FOR ELEVATION SHOWS (1987 & MEC) SOUTHWESTERN OF 2 SHEETS . PROJECT GENERAL DYNAMICS PALUXY AQUIPER INVESTIGATION 12. MANUFACTURER'S DESIGNATION OF DRILL PAILING 1500 USCE HOLE NO. (As about an dearing state and the manded 13. TOTAL NO. OF OVER-MURDEN SAMPLES TAKEN 0_ 8A4C-101 14. TOTAL NUMBER CORE BOXES NAME OF ORILLER BREWER IS ELEVATION GROUND WATER IS. DATE HOLE VERTICAL MINCLINED 2/11/86 2/11/86 17. ELEVATION TOP OF HOLE 7. THICKNESS OF OVERBURDEN 47.5 18. TOTAL CORE RECOVERY FOR BORING S. DEPTH DRILLED INTO ROCK 4.0 19. SIGNATURE OF INSPECTOR S. TOTAL DEPTH OF HOLE REMARKS
(Drilling time, mater loss, measuring, etc., if algor SOX OR SAMPLE NO. CLASSIFICATION OF MATERIALS S CORE ELEVATION DEPTH LEGENO 40.€ 47.5 to 51.5 IMESTONE, brown, fine to coarse grained, argillaceous throughout isua with many stringers and dent thin seams noted, fossiliferous, in-place fractures noted, soft. T.D.-51.5' 0.9 51.5 60 m 70.0 ENG PORM 1836 PREVIOUS EDITIONS ARE OBSOLETE.

| | | | | | | | | Mole No. 8A4C-102 |
|------------------------|-------------------|----------|--|----------|-----------|-------|-------------|--|
| DRIL | LING LO | . | OUTHWESTERN | POR' | r WORT | 'H | _ | SHEET 1 |
| GENER | | NAMIC | cs | 10. SIZE | AND TYP | E OF | SIT TTOK | 8"AUGER, 4"CCRE |
| PALUX PALUX USCE | Y AQU | IPER | INVESTIGATION | 12. MAN | UFACTUR | | | ING 1500 |
| USCE L HOLE NO. | | | and state! | 13. TOT | AL NO. OF | | | DISTURBED UNDISTURBED |
| HAME OF | | | 8A4C-102 | | AL HUMBE | | | <u> </u> |
| BRE | WER | | | _ | VATION G | _ | 0 44 | YER ## |
| L DIRECTIO | | | D DES. FROM YERT. | | E HOLE | | 2/ | 12/86 2/14/86 |
| . THICKNES | S OF OVE | ROURDE | ™ 60.5 | _ | VATION TO | | _ | V FOR BORING 86.3% |
| . DEPTH OF | | | | | ATURE OF | 1918 | 7CT | OR / th |
| . TOTAL DE | | | 80 . 0 CLAMIFICATION OF MATERIA | | 1 CORE | NO. | _ | REMARKS |
| ELEVATION 4 | DEPTH | LEGENO | (Peseriptim) 6 | | RECOV- | SA N | O. | (Brilling that, unter lean, depth of wanthering, era., if algoriticard) |
| | • • | | 0.0 to 0.2 | | | 1 | | 1) Duming sugaring |
| | | | ASPHALT, good cond | | | | | 1) During augering Free water encountere |
| | | | ASPIALL, good cond | 11 610 | ľ | | | @35.0ft. below grade. |
| | = | | 0.2 to 1.0± | | | | | Static water level taped at 34.0ft. below |
| | | | SAND, fine to coar | rse . | ! | | | grade. |
| | | | grained, loose, dr | ту, | 1 | 1 1 | | l E |
| | | | gravelly, brown. | | l | | | |
| | \exists | | 1.0 to 6.5± | | J |] . [| | l E |
| | | | | | | vi: | | |
| Ì | | | CLAY, low plastic: soft, moist, grave | | | - | | 2) JARS |
| | ٠٥. ٥] | | calcareous, tan to | | | | | visual identification |
| } | - = | | brown. | | | | | Visual Identification |
| | | | 6.5 to 44.0+ | | | | | <u> </u> |
| | ∃ | | CLAY, low to mediu | ım. | |] | | E |
| 1 | | | plasticity, soft t | :0 | | | | E |
| | = | | stiff, moist to we along basal section | | | ļ | ı | |
| 1 | \Box | | calcareous with li | | | } | | E |
| | 7 | | nodules and blebs | | | | | 3) <u>DRILLING</u> |
| i | ヨ | | especially from 31.0±34.0; becomin | g | | | | 0.0 - 60.5, 8"auger |
| ł | ⇒ | | increasingly sandy | , | | | | refusal at top of limestone primary. |
| ا | ₽ | | below 39.0'to dept | n, | | | | 60.5 - 61.0. 7 ⁷ /8" E |
| | E | | 44.0 to 60.5 | | | | | rock bit. |
| 1 | # | | CLAY, medium to hi | ah. | , | | | 61.0 -80.0, 4"core |
| ŀ | 目 | | plasticity, stiff | | | | | to depth. |
| ļ | ∃ | | hard in zones, wet | | | | | Remarks |
| ľ | ⇉ | | calcareous, reddis | n- | | | | A) Casing advanced to top of primary and |
| | Ξ | | | | | vic | | reamed. |
| | 긐 | | 60.5 to 6'24 | | | ide | nt | P) vocy of a grantegy |
| İ | ∄ | | LIMESTONE | | | | | into primary and hole surged. |
| | 日 | | 60.5 - 61.4, bro | wn, | | | | C) After coring, hole |
| | 7 | | fine to coarse grained, strongl | , | | | | bailed repeatedly unti |
| þ | »- Д | | argillaceous, hig | | | | | nearly dry. Two 94145 |
|] | ∃ | | fossiliferous, so | ft. | | | | bags of cement used to grout hole. Grout |
|] | 크 | | $\frac{61.4 - 61.8}{61.00}$, tan | | | | | extended to |
| | ∃ | ' | fine to coarse grained, arenace | ous. | | | | approximately 55.0ft datum below grade. |
| 1 | | | moderately hard. | | | | | Casing subsequently |
| 1 | 3 | | 61.8 - 62.4 gra | | | | [] | withdrawn. |
| ļ | | | fine grained, sli argillaceous, wel | ghtl | | | | D) Boring backfilled |
| | = | | cemented, hard. | • | | | | with cuttings. |
| 1 | 3 | | - | | | | | E) Ground water sample obtained for analysis. |
| j | ╡ | | | | | | | F) Boring offset |
| | | - 1 | | ĺ | | | ιÍ | Saven feet due west |

| | | | | | | | Hole | No. 8A4C | =102 |
|----------------------|------------------|--------|---|-----------|-----------------------|-----------------|----------------|-------------------|-------------|
| DRIL | LING LC | | SOUTHWESTERN | HESTALL | | 1.7 | | | T 2 |
| I. PROJECT | | | | 10. SIZE | WORT | E OF BIT | 8 "AUGER. | +"CORE | ante 18 |
| GENERA! | DYN | AMICS | | TI. DAT | JE POR E | EVATIO | SHOWN (1888 as | (100) | |
| PALUXY | AQUI | PER I | NVESTIGATION | 12. MANI | UPACTURI | tr's oasi | SHATION OF DA | ILL - | |
| 1 ORILLIMA USCE | AGENCY | | | | | | G 1500 | 1 | |
| 4. HOLE NO. | (As short | - | | 12. TOT | AL NO. OF DEN SAMP | LES TAKE | EM O | : | O |
| B. HAME OF | DRILLER | | 8A4C-102 | | AL HUMBE | | | | |
| BREWER | | | | IS. ELE | VATION OF | | | | |
| 6. DIRECTIO VERTI | | | D DE6. PRGM VERT. | M. DAT | E HOLE | | 12/86 | 2/14/ | |
| 7. THICKNES | | | | 17. ELE | VATION TO | ○P ○F HO | LE | | |
| B. DEPTH DE | | | | | AL CORE | | Y FOR BORING | 94.3 | |
| 9. TOTAL DE | PTH OF | HOLE | 80.0 | | R | R.A. | rdette | | |
| ELEVATION | DEPTH | LEGENC | CLASSIFICATION OF MATERIA | 14 | S CORE | BOX OR | | EMARKS | desch of |
| | <u> </u> | | | | ERY | NO. | useathering. | etc., if election | (Scard) |
| | 40.0 | 1 | | ! | | 1 1 | 1 | | F |
| | = | 1 | 62.4 to 63.1 | | Ì | 1 1 | ľ | | |
| | Ξ | | SHALE, dark brown, | , | | 1 1 | ł | | E |
| ì | | l | laminated, arenace | ous, | | | ļ | | E |
| | | l | soft. | i | | 1 1 | } | | E |
| | = | | 63.1 to 66.5 | | | |] | | F |
| | = | Į | | | | visus | 1 | | F |
|] | Ξ | | SAND, fine grained weakly camented, | 4 9 | | iden | I | | E |
| j | | | silty, calcareous | | | ĺ | [| | E |
| | | | throughout, light | gray | | 1 | | | ╞ |
| | ,,] | | ((, , , , , , , , , , , , , , , , , , | | | 1 1 | | | F |
| 1 | 50.0 | | 66.5 to 77.6 | | | | 1 | | E |
| | | | SHALE, dark brown, very thinly bedded | | | | | | Ε |
| į | 7 | | arenaceous, soft. | ^• | | | 1 | | ⊨ |
| | 7 | | | | | |] | | F |
| | -3 | | 77.6 to 80.0 | | | | | | F |
|] | = | | SAND, fine grained | i. ' | | - | , | | E |
| | | | with coarse grains | ed | | [[' | | | Ł |
| | 3 | | sands noted, weakl cemented throughout | | | ' | | | F |
| - 1 | = | | coarse grained | `'' | | | | | E |
| İ | ╡ | | uncemented zones | 1 | | | | | E |
| i | . = | 1 | throughout, silty, very soft. | • | | | i | | E |
| ř | 60. 0 | | 1 101, 30100 | - 1 | 410 | RACK BE | | | F |
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| } | 彐 | | | Ì | | | | | F |
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| l | - コ | | | ĺ | 65 46.5 | • | | | E. |
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| DRIL | LIME LO | ••• 1 ° | OUTHWESTERN | HISTALI | PORT # | (OB) | ጥዝ | | OF 2 SHEETS | } |
| I. PAGJECT GENERA | | AMICS | S | M. MIE | AND TYP | 2 07 | 917 | 8"AUGER, 4" | CORE | 7 |
| PALUXY | AQUI | | INVESTIGATION | 12. MAN | UFACTUR | EN S | 6 E Si | SHATION OF BRILL | | 4 |
| USCE | AGENCY | | | <u> </u> | | | | G 1500 | ! UNDISTURBED | 1 |
| A HOLE NO. | (Ac obs- | | 8A4C-103 | II TOT | AL HOLOS | , S. | TAKE | 0 | 0 | 1 |
| L HAME OF | CALLER | | (OX40-10) | | AL HUMBE | _ | _ | | | 7 |
| BREW | | LE | | | VATION 6 | | | | HPLETED. | -{ |
| A VERTI | | IMCL IN E | | ├ | E HOLE | | | | /19/86 | 4 |
| 7. THICKNES | 8 OF OV | ERBURDE | DN 57.0 | | VATION TO | | | | 0.0% | - |
| L DEPTH OF | | | <u></u> | | ATURE OF | | | | | Ħ |
| e, fotal De | | | 65.0 CLASSIFICATION OF MATERIA | | S COME | 90X | K - 4 | REMAIL REMAIL | RKS | ┨ |
| ELEVATION | | LEGENC | (Description) | | RECOV | 200 | PLE O | | of local depth of | |
| | 0.0_ | 1 | | | | 1 | | 1) During | augering | E |
| | _= | | 0.0 to 0.5 | |] | | | free water | measured | E |
| | = | } | ASPHALT, good con | ditio | r. | 1 1 | | # 35.0 ft. grade. Sta | | E |
| | | 1 | 0.5 to 1.5± | | } | 1 1 | | level tape | ed at 36.5 | |
| | Ξ | } | SAND, fine to coan | | } | 1 | | below grad | le. | E |
| | - | } | grained, loose, di | | i | 1 1 | | | | F |
| | | } | gravelly, brown. | | | 1 1 | | | | E |
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| | Ţ | l | 1.5 to 3.0 [±] | | { | 1 - | sua | _ | | F |
| | | } | CLAY, low plastic: | | | iid | ent | • | | E |
| | 10.0 | 1 | sandy, gravelly, | | | 1 1 | | | | F |
| , | _ = | } | to brown. | | | | - 1 | 2) <u>JARS</u> | | F |
| | - | • | 3.0 to 10.6± | | | [| | visual iden | tification | F |
| | = | | CLAY, medium to h | l an | | 1 1 | | | | F |
| 1 | П | | plasticity, stiff | | | | | | | E |
| | - = | | moist, sandy, gra- | velly | • | | 1 | | | E |
| i | | | calcareous with li nodules and seams | ımy | | | - 1 | | | E |
| Ì | ╡ | | in section, reddis | sh- | | | - 1 | | | E |
| } | | | brown. | | | | i | 3) DRILLIN | iG | F |
| 1 | = | i | 10.6 to 27.0* | | | ii | - 1 | 0.0 - 57.0 | | ·Ε |
| }. | 20.0 | | CLAY, low plastic | itv. | | 1 | |) | | F |
| } | ∄ | | soft, moist, sand | | | | - 1 | | | E |
| (| | | throughout with a | | | | | 57.0 - 65. | .0, 4"core | E |
| } | 3 | | strong sand fract: noted @ 21.0223.0 | : 1 | , | | uai | to depth. | | F |
| (| 크 | | gravels noted 224. | 0'to | . 4 | | nt | Remarks: | د - د مدمود د م | E |
| · · · · · · · · · · · · · · · · · · · | 3 | | tan. | | | } } | } | A) Casing to top of p | rimary: | F |
| 1 | 3 | | | | | | | boring sur | | E |
| į | hilini | | 27.0 to 33.0 [±] | į | | | ļ | B) After o | | æ |
| j | 크 | | CLAY, medium to h | igh | | | - { | bailed repuntil near | | E |
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| } | 30.0 | | with limy nodules | and | | |] | used to gr Grout exte | out hole. | Es+ |
| ļ | = | | blebs in section, reddish-brown. | ł | | | l | 5 feet abo | ve primar | |
|] |] | | | } | | |) | contact. (| | JE. |
| ì | 日 | | 33.0 to 57.0 |) | | |) | C) Boring | - | - |
| 1 | _= | | CLAY, low plastic | | | | ł | backfilled | | F, |
| J | \exists | | soft, moist, sand throughout,calcar | | | | Į | cuttings. | | E |
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| MG FORM | | | | | PROJECT | 4 | | | HOLE NO. | |

8A4C-103 STALLATION DRILLING LOG FORT WORTH of 2 SHEETS SOUTHWESTERN 10. SIZE AND TYPE OF SIT 8 "AUGER, GENERAL DYNAMICS PALUXY AQUIFER INVESTIGATION

ORIGINAL AGENCY
USCE IL MANUPACTURER'S DESIGNATION OF BRILL FAILING 1500 0 13. TOTAL NO. OF OVER-HOLE HO. (As als 8A4C-103 IL TOTAL NUMBER CORE BOXES HAME OF BRILLES IL ELEVATION GROUND WATER M. DATE HOLE 2/18/86 TVERTICAL MINCLINED 17. ELEVATION TOP OF HOLE . THICKNESS OF OVERBURDEN 57.0 19. TOTAL CORE RECOVERY FOR SORING 70.0% DEPTH DRILLED INTO ROCK 8.0 R.R.A udetta TOTAL DEPTH OF HOLE 65.0 BOX OR SAMPLE NO. REMARKS CLASSIFICATION OF NATERIALS ELEVATION DEPTH 40.0 57.0 to 60.5 CLAY-SHALE, tan to greenish-gray, calcareous, soft. 60.5 to 61.6 LIMESTONE, tan to gray fine to coarse grained visual arenaceous, weathered, ident. siliceous zones noted in section, fossiliferous moderately hard. 50.0_ 61.6 to 62.4 SHALE, dark brown, laminated, arenaceous, soft. 62.4 to 65.0 SAND, fine grained, weakly cemented throughout, calcareous very silty, becoming 57.0 2.0 59.0 strongly argillaceous below 63.8' to depth; light gray to brown along basal section. å.5 60.0 1 ٥.0 T.D.-65.0' 70.0 .0 NG FORM 1836 PREVIOUS EDITIONS ARE OSSOLETE.

| CENERAL LOCATION | AQUIP | MICS | | 10. 9178 | WORT | OF ":" | S"AUGER | SA 4C-104 SHEET 1 OF 1 SHEETS | |
|--|--|---------|---|----------|----------|---------------|----------------------|-------------------------------------|-----|
| GENERA LOCATION PALUXY SORILLIMO USCE MOLE NO. | L DYNA | MICS | | 10. 9178 | - | OF ":" | S"AUGER | 10 | ł |
| E LOCATION PALUXY SORILLING USCE A HOLE NO. (A HOLE NO. (| AQUIP | or \$4. | | II. DAY | POR E | EVATION | | | J |
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| USCE | | | NVESTIGATION | 12. HAN | PACTURE | WE DES | SNATION OF BAILL | | ł |
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| | - | - | ng Hillo | 13. TOT | NEW BANK | .es yakı | M O | 0 |) |
| | A11 1 44 | | 8A4C-104 | 14. TOT | - | A CORE | OKES 1 | | 1 |
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| s. DIRECTION | | | | H. DATI | I HOLE | | | 2/20/86 | 1 |
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| 7. THICKNESS | | | | | | | Y FOR BORING | , | 1 |
| B. DEPTH DRI | | | <u></u> | 19. SIGN | ATURE OF | Aud | TOR HD | | 1 |
| S. TOTAL DE | PTH OF HO | | 40.7 | | a cone | | REMA | AKS | ł |
| | DEPTH | GEND | CLAMIFICATION OF MATERIA (President) | | | SAMPLE HO. | (Drilling time, man | er loss, depth of if eignificant | 1 |
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| 1 | E | ı | 0.0 to 0.5 | | | | | augering | E, |
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| 1 1 | ⇉ | | ASPHALT, good con | UI UIG | , | 1 1 | | ter level | |
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| 1 1 | ㅋ | ł | | | | | grade. | | E |
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| j (| • | į | 2.5 to 35.7 | | | visua | F | | 上 |
|) | 7 | - [| CLAY, low plastic | itv | | ldent | ŀ | | F |
|) . | ٠, ٦ | J | to medium plastic | ity. | | 1 1 | | | F |
| | - | } | soft, moist to we | t | | | 2) JARS | | E |
| 1 | Ξ | - } | along basal zone, calcareous with 1 | inv | | | visual ide | ntificatio | E |
| | | } | nodules and blebs | | | | 115441 146 | | E |
| 1 | ⇉ | } | section, sandy wi | | | } } |] | | F |
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| 1 | = | | fine to coarse gr | ained | | | 3) DRILLI | <u>NG</u> | E |
| 1 | ヸ | - 1 | prominent fractur | e | | 1 1 | | 7, 8"auger | E |
| : | 20-0 | | noted @ 36.7; siliceous, highly | | | | refusal a | | 上 |
| | 7 | ĺ | fossiliferous in | | | 11 | | | F |
| l j | _= | ļ | section, moderate | ly | | 1 1 | 35.7 - 40. to depth. | 7, 4"core | F |
| | 3 | | hard. | | | | | | E |
| | 3 | J | T.D40.7° | | | | Remarks: | | E |
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| | 40.0 | | | | 40.1 | | | · | F |
| ENG FORM | 1836 - | IE VIOL | IS EDITIONS ARE OGROLETE. | | PROJECT | | | HOLE NO. | |

Hole No. 84-105 METALLATION FORT WORTH DESLLING LOG SOUTHWESTERN M. MEE AND TYPE OF MY 8"AUGER THE REST GENERAL DYNAMICS PALUXY AQUIFER INVESTIGATION 12. MANUPACTURER'S DESIGNATION OF ORILL PAILING 1500 USCE
L HOLE NO. (As shown as dearing title and Electronical) 13. TOTAL NO. OF OVER-8A-105 E MANUEL OF ROLL & ST IS ELEVATION GROUND WATER BREWER DIRECTION OF HOLE 2/21/86 IS. DATE HOLE 2/21/86 ZOVERTICAL | INCLINED. 17. ELEVATION TOP OF HOLE 57.0 7. THICKNESS OF OVERBURDEN 18. TOTAL CORE RECOVERY FOR BORING B. DEPYN DRILLED INTO ROCK 0.0 M SIGNATURE OF IMPRECTOR R.R. Andette 57.0 REMARKS
(Drilling time, water less, depth of smallering, ere., if significant) RECOVE SAMPLE CLASSIFICATION OF MATERIALS 0.Œ 1) During augering 0.0 to 0.6 free water encountered @ 36.0ft. below ASPHALT, good condition grade. Static water level taped # 34.5ft. below grade. 0.6 to 2.4± SAND, fine to coarse grained, loose, dry, gravelly, brown. 2.4 to 54.0 ± isua ldent CLAY, low to medium plasticity, soft to 2) JARS g Hillindini stiff at depth, moist visual identification to wet at depth, calcareous with limy nodules and seams in section, sandy throughout especially 11.0-14.0; 19.0'-25.0' light gravels noted 943.0-44.0; tan. 54.0 to 57.0 3) DRILLING 0.0 - 57.0, 8"auger refusal at top of CLAY, medium to high plasticity, stiff, wet, calcareous, 20 -0 limestone primary. Fragments of limestone slightly gravelly, reddish-brown. noted on stinger. 57.0 risua LIMESTONE, (auger identi refusal on top of limestone). T.D.-57.0' 40.0 ENG FORM 18 36 PREVIOUS EDITIONS ARE OSSOLETE.

OUS EDITIONS ARE CHIDLETE (TRANSLUCENT)

Male No. Bn-105

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| THICKNES | | | <u></u> | | | | Y FOR BORING | , |
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| EVATION. | | FEGENO | CLAMIFICATION OF MATERIA | | RECOV- | SAMPLE HO. | | ater loss, depth of |
| • | 0.0 | ┝╌┤ | | | - | \ | | 1 |
| 1 | - | | | | l | [| 1) Durina | augering |
| | _= | [Ì | 0.0 to 0.7 | | 1 | | | er measure |
|] | _ |] [| ASPHALT.good cond | ition | } |]] | at 35.01 | |
| | Ξ | | | | | | grade. | |
| - 1 | - | l / | 0.7 to 1.8 t | | | | - Static | water leve |
| } | = | j | SAND, fine to coa | rga | | | taped at | 33.5 ft. |
| ĺ | _= | [[| grained, loose, d | rv. | | [[| below gra | de. |
| - 1 | | | clayey, brown. | - , , | | | | |
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| ĺ | | | 1.8 to 8.0 [±] | | | | | |
| | 3 | | | | | , ' | ļ | |
| 1 | 10.0 | | CLAY, low to medi- plasticity, soft, | | t. | visus | | |
| | 40.0 | [| slightly gravelly | | • • | ident | ļ. | |
| ļ | = | | calcareous, tan t | | | ' | 2) <u>JARS</u> | |
| 1 | | [| brown. | | | i i i | visual id | lentificati |
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| | _= | 1 | 8.0 to 10.5 [±] | | | | l . | |
| | | | SAND, fine to com | rse | | | { | |
| | \equiv |] | grained, loose, m | oist, | |]] | ļ | |
| | _ | | very clayey throu | ghout | • | , | | |
| - 1 | \exists | | calcareous, tan. | | | 1 1 | ו זדמו (2 | TNC |
| ļ | 3 | | العاد الماما | | | | 3) <u>DRILI</u> | |
| | = | | 10.5 to 14.02 | | |] [| | 0, 8"auger |
| ĺ | _ ∃ | } | CLAY, low plastic | | | 1 | refusal a | it top of e. Fragment |
| ļ | 50 Q | | soft, moist, very | | | | | one noted |
| | 7 | | sandy throughout, calcareous, tan. | | | | on stinge | |
| J | \exists | . | CTICAL BOND! CALL! | | |]] |] | |
| J | = | 1 | 14.0 to 16.5+ | | | | 1 | |
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| J | -3 | j | SAND, fine to coa | | | iden | | |
| j | milini | , , | grained, loose, m | | _ | ' | | |
| - 1 | 3 | 1 | very clayey throu calcareous, tan. | Ritoria | • | | } | |
| 1 | 3 | . 1 | Ammany change with | 9 | | | | |
| ĺ | \exists | - 1 | 16.5 to 44.0± | | | 1 1 | l | |
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Hole No. 8A-108 DRILLING LOG PORT WORTH OF 2 SHEETS SOUTHWESTERN a let W. SIZE AND TYPE OF SIT 8 "AUGER GENERAL DYNAMICS PALUXY AQUIPER INVESTIGATION
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HOLE NO. (As shown as downing total) 12. MANUFACTURER'S DESIGNATION OF BRILL PAILING 1500 13. TOTAL NO. OF OVER-0 0 8A-108 14. TOTAL NUMBER CORE BOXES A HAME OF BRILLER IL ELEVATION GROUND WATER 3/6/86 3/6/86 MVERTICAL MINCLINED 17. ELEVATION TOP OF HOLE -- 648,82 48.0 7. THICKNESS OF OVERBURDEN M. TOTAL CORE RECOVERY FOR SORING L DEPTH DRILLED INTO ROCK 0.0 19. SIGNATURE OF INSPECTOR udatta 48.0 REMARKS RECOVE SAMPLE CLASSIFICATION OF MATERIALS (Drilling time, unter love, depth of weathering, etc., if eignificant) DEPTH LEGEND 0.0 1) During augering 0.0 to 0.6 miniment of second and and an inclination of the second and an inclination of the second and an inclination of the second and an inclination of the second and an inclination of the second and a second a second and a second and a second and a second and a second and free water measured ASPHALT, good condition at 37.0ft. below grade. 0.6 to 2.5 -Static water level taped at 34.0ft SAND, fine to coarse below grade. grained, loose, dry, clayey, brown. 2.5to 9.5± visual GRAVEL, fine to coarse grained, angular to subangular, loose to ident. 2) JARS medium dense, moist, visual identificati clayey, sandy, tan. 9.5 to 12.5 SAND, fine grained, loose, moist, clayey, 3) DRILLING

0.0 - 48.0, 8"auger refusal with auger scraping at top of limestone. Fragments of limestone noted on stinger. calcareous, tan. .3) DRILLING 12.5 to 17.5* CLAY, low to medium plasticity, soft to stiff, moist, sandy, tan. 17.5 to 19.0[±] visual ident. SAND, fine grained, loose, moist, very clayey, tan. 19.0 to 21.0± CLAY, low to medium plasticity, soft to stiff, sandy, tan. 21.0 to 23.5 SAND, fine grained, loose, moist, clayey, slightly gravelly, tan. 23.5 to 48.0± CLAY, medium to high plasticity, stiff, moist to wet along basal section, calcareous with limy nodules and blebs in section, tan.

ENG FORM 1836 PREVIOUS EDITIONS ARE OBSOLETE.

MSYALLATION DRILLING LOG SOUTHWESTERN FORT WORTH 10. SIZE AND TYPE OF BIT 8 "AUGER GENERAL DYNAMICS
LOCATION (Constitution or Sention)
PALUXY AQUIPER INVESTIGATION
ORNLING AGENCY
USCE 12. MANUPACTURER'S DESIGNATION OF DRILL IS. TOTAL NO. OF OVER-0 8A-108 14. TOTAL HUMBER CORE BOXES HAME OF DRILLER IL ELEVATION GROUND WATER BREWER 3/6/86 3/6/86 TVERTICAL MINCLINED 17. ELEVATION TOP OF HOLE 48.0 7. THICKNESS OF OVERSURDEN DEPTH DRILLED INTO ROCK R.A . TOTAL DEPTH OF HOLE 48.0 CLASSIFICATION OF MATERIALS LEGEND DEFTH 48.0 LIMESTONE, (auger refusal at top of visual ident. limestone). T.D.-48.0' 80.0 BNG FORM 18 36 PREVIOUS EDITIONS ARE OSSOLETE.

Hole No. SASP-109

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| ŀ | _ | 1 | CLAY, medium to | high | | ! ' | | | |
| ì | = |) | plasticity, stif | f. | } | vis | | | |
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Hole No. SASF-104

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|--------------|---|----------|--|--------------|-------------|----------------|--------------------------|--|--------------|
| DRIL | LING LOG | <u> </u> | VISION | POP | ATION T | nu. | | SHEET I | 1 |
| 1. PROJECT | | | SOUTHWESTERN | 10. SIZE | AND TYP | OF BIT | 8"AUGER 32 | | 1 |
| | L DYNA | | | 11. BAT | JII FOR E | EVATIO | SHOWN (THE & THE | | 1 |
| PATIUXY | AQUITE | PER 1 | INVESTIGATION | 18 414 | WEAT - 10 V | | MATION OF SHILL | | 4 |
| 3 ORILLING | | | | | | | NG 1500 | | 1 |
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| | | | 8A3F-110 | | AL NUMBE | | i | <u>: </u> | - |
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| BREWE | M OF HOLE | | | | | 187 | ARTED ICO | MPLETED | ┨ |
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| 7. THICKNES | S OF OVER | ROURDE | w 46.0 | | VATION TO | | | 7.22 | 1 |
| e. DEPTH DI | ILLED INT | O ROCK | | | ATURE OF | | Y FOR SORING _ | <u>- </u> | 4 |
| S. TOTAL DE | EPTH OF H | OLE | 238.0 | 1 | R | RA | dette | | |
| ELEVATION | DEPTH L | EGEND | CLASSIFICATION OF MATERIA | 4 | S CORE | BOX OR | (Drilling time, wat | RKS | 7 |
| | | • | 4 | | ERY | NO. | Protecting, etc., | or loos, depth of it significant | 1 |
| | 9.9- | | | | | 1 | 4) | | F |
| | 7 | | 0.0 to 0.4 | | ! | 1 1 | 1) During | | Ŀ |
| | | | ASPHALT, good con | 41+10 | _ | | | er measure below grad | |
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| j i |] |] | 0.4 to 1.7 ± | | l | | taped at | 32.8 ft. | E |
| \ | ======================================= | 1 | | | l | } } | below gra | de. | E |
| | = | 1 | SAND, fine to coa grained, loose, d | rv. | l | | ! | | E |
| | | | gravelly, clayey, | - J T | | | 1 | | F |
| | milini | | brown. | | | | 1 | | F |
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| | 7 | - 1 | 1.7 to 5.3 [±] | | | ! | 2) <u>JARS</u> | | F |
| | ,,⊒ | | CLAY, low plastic | ity, | | 1 | visual ide | ntificatio | · F |
| | 10-0 | - ! | soft, moist, grav | elly | | | | | F |
| | = | l l | sandy, calcareous | • | | visu | L, | | E |
| | | | tan. | | | iden | | | E |
| | ∄ | | 5.3 to 35.0 | | | | } | | E |
| | | | | | | | | | 上 |
| 1 | = | | CLAY, medium plas | tici | У• . | | 3) DRILLII | 1G | E |
| ! `:\ | . = | , l | zones, moist to w | et | | 1 1 | 0.0 - 35.0 | | . = |
| l· i | 「 コ . | İ | along basal secti | on, | | | refusal a | | = |
| | = | | sandy along topmo | | | | coarse bas | sal gravel | · F |
| j | \exists | | section with stro arenaceous zones | | | | 4"i.d. cas | | F |
| 1 | Ⅎ | | a 11.0-14.0: 16.0 | -18 | 5' | | at top of | gravels. | Ε |
| | 20.0 | | calcareous with 1 | | | | Annulus fi bentonite | | |
| | - " = 1 | | nodules and blebs section. tan. | in | | | | . • | E |
|] | 7 | | section, tan. | | | l | 35.0 - 230 fishtail | to depth. | F |
| l i | \exists | İ | 35.0 to 46.0 | | | visua ident | <u> </u> | | ⊨ |
| | \exists | | | | | | Vemer.var | | Ė. |
| | \exists | ı | GRAVEL, coarse gr very dense to har | | • | | A) No hydi in drilli: | | |
| | Ξ | ŀ | wet, sandy, tan t | | | | upper and | | E |
| | ゴ | | gray (logged thro | ugh | | | Paluxy to | top of | E |
| i i | ⇉ | 1 | cuttings and dril action) | T] | · · | | Glenrose | | E |
| | ⇉ | l | ac atom) | | | | exceptions 104.0-104 | 98.0-98 | 1 |
| | ㅋ | | 46.0 to 57.0.+ | | | | 109.5-111 | .0.126.6-1 | 27.4 |
| | 7 | | | | Ĺ | | 173.5-176 | .3. | F |
| | 30 . 0 | | LIMESTONE, tan to fine to coarse gr | | | | B) 240 ft | of tremie | F |
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| | E | | cuttings and dril | 1 | | | depth. | | E |
| | Ⅎ | ļ | action). | | | | c) twenty | | E |
| | ⇉ | i | | | | | ninety-for | | E |
| | ⇉ | 1 | 57.0 to 58.5 | | | | cement use | ed in grou | ine |
| | # | | SHALE, gray to da | rk | | | hole from | depth to | F |
| | ヸ | | gray., silty, sof | ţ ^ | | | grade us: | ing a rati | <u></u> |
| | \exists | Į | in section, (logge through cuttings | | | | of 7 to 7 water to | | |
|] | 三 | Ì | E-1dgging). | | | | | te: a 1:6 | |
| | 30 .0 | ļ | | | | | ratio att | empted, | F |
| | 40.0 | ļ | | | | | viscosity | too high | For |
| ENG FORM | | | S EDITIONS ARE OSSOLETE. | | PROJECT | L.¥ | mixing an | paratus HOLE NO. | |
| MAR 71 | .0.30 | MEVIOU | S EURTIONS AND DESCRIPTE. | l l | | | | 1 | |

Hole No. SA3F-110 SYALLATION DEILLING LOG SOUTHWESTERN FORT WORTH OF 6 SHEETS 11. BAYUN FOR ELEVATION THOSE OF MEAN THE CONTROL OF MEAN THOSE OF MEAN ENERAL DYNAMICS PALUXY AQUIFER INVESTIGATION 12. MANUFACTURER'S DESIGNATION OF ORILL FAILING 1500 USCE 12. TOTAL NO. OF OVER-HOLE HO. (As shows on dearing title 8A3F-110 IL TOTAL NUMBER CORE BOXES HAME OF DRILLER IS ELEVATION GROUND WATER BREWER ** 3/18/86 M. DATE HOLE 3/13/86 X VERTICAL TINCLINED DES. PROM VERT 17. ELEVATION TOP OF HOLE 7. THICKNESS OF OVERSURDEN 46.0 18. TOTAL CORE RECOVERY FOR BORING DEPTH DRILLED INTO ROCK 92.0 R.R. A. . TOTAL DEPTH OF HOLE 238.0 RECOV-BOX OR SAMPLE NO. CLASSIFICATION OF MATERIALS REMARKS ELEVATION DEST LEGENG 10.OL D) After 19 bags used in grouting, 58.5 to 61.2 an initial grout SANDSTONE, very fine grained, silty. level of 2. Oft below grade was noted. calcareous, soft. Tremie pipe was (logged through cuttings and E-log). subsequently removed. A final grout level of 10.0ft below grade was noted at plus 61.2 to 73.0± 20 hours. An additional SHALE, dark gray, arenaceous with One-half bag of cement was used to grout to grade using the same 1:7 grout abundant sandstone seams and stringers in section, soft. ratio. (logged through E) All auger cuttings cuttings and E-log). visual were removed and visual stored in sample bags. ident. 73.0 to 85.5 P) Two samples of SANDSTONE, fine to coarse grained, silty, drill water obtained for analysis by SWD calcareous, shaly with inferred shale stringers and seams, soft. (cuttings and G) Boring offset 7.071. E-log). ے۔ 85.5 to 106.0² SHALE, dark gray, inferred sandstone stringers and seams in section, soft. (logged through E-log and cuttings). visual 106.0 to 112.0 ident SANDSTONE, fine grained, silty, calcareous, inferred shale stringers in section, soft.(logged through cuttings and E-log). 112.0 to 166.0[±] SANDSTONE, fine to coarse grained, silty, calcareous, soft. (logged through E-jog and cuttings). 166.0 to 167.5 SHALE, dark gray, soft. (logged through E-log). ENG FORM 18 36 PREVIOUS EDITIONS ARE OSSOLETE.

STALLATION OF 6 SHEETS DRILLING LOG SOUTHWESTERN PORT WORTH M. SIZE AND TYPE OF MY 8"AUGER, FISHTAIL DYNAMICS PALUXY AQUIPER INVESTIGATION 12. MANUFACTURER'S DESIGNATION OF DRILL FAILING 1500 11. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN 0 8A3F-110 14. TOTAL NUMBER CORE BOXES IS. ELEVATION GROUND WATER 3/13/86 3/18/86 ZVERTICAL MINCLINED 17. ELEVATION TOP OF HOLE 7. THICKNESS OF OVERBURDEN 46.0 16. TOTAL CORE RECOVERY FOR SORING DEPTH DRILLED INTO ROCK 1920 TOTAL DEPTH OF HOLE 238.0 S CORE BOX OR SAMPLE CLASSIFICATION OF MATERIALS REMARKS (Delling time, states from machines, etc., if eign 80 3 16 7.5 to 230.0 + SANDSTONE, fine to coarse grained, silty, calcareous, inferred shale seams and stringers in section, soft. (logged through cuttings and E-log) visual 230.0 to 236.0[±] ident. SHALE, dark gray, arenaceous with sand seams and stringers in section, soft. (logged through cuttings and E-Log). 236.0 to 238.0 LIMESTONE, light gray; fine grained, hard(logged through cuttings and E-Log). 100 T.D.-238.0' /isua dent 120 -0: ENG FORM 1836 PREVIOUS EDITIONS ARE DESOLETE.

SASF-110 SHEET 4 of 6 SHEETS METALLATION DRILLING LOG SOUTHWESTERN PORT WORTH 11. DAYUM FOR ELEVATION SHOWN (TEM - MEG) GENERAL DYNAMICS
LOCATION (Continues of Section)
PALUXY AQUIPER INVESTIGATION
5. GRILLING AGENCY 12. MANUFACTURER'S DESIGNATION OF GRILL PAILING 1500 13. TOTAL NO. OF OVER-8A3F-110 14. TOTAL NUMBER CORE BOXES IL ELEVATION SHOUND WATER 3/13/86 M. DATE HOLE 3/18/86 MVERTICAL CINCLINED 17. ELEVATION TOP OF HOLE 7. THICKNESS OF OVERSURDEN 46.0 DEPTH DRILLED INTO ROCK 192.0 238.0 TOTAL DEPTH OF HOLE (Dylling time, water loos, westering, otc., if eight CLASSIFICATION OF MATERIALS BOX OR SAMPLE E CORE DEPTH 120 0 130. visual ident. 140visual ident. 150.0 ENG FORM 18 36 PREVIOUS EDITIONS ARE OSSOLETE-

| | | | | | | Hel | Ma. 843F-110 | _ |
|----------------------------|---------------|-------------------------|----------|----------------|-------------------------|--------------|---------------------------------------|----|
| DRILLING LOG | SOUTH | WESTERN | 2020 | ATION WORTH | í | | OF 6 SHEETS | .] |
| I. PROJECY | | eta 4 es 44 . | | | | 8"AUGER | FISHTAIL | 1 |
| GENERAL DYNAMI | cs | | TI. BAT | OR POR EL | EVATION. | SHOOM (1884) | - HC) | 7 |
| PALUXY AQUIFE | RINVE | STIGATION | 12. WAN | UPÄCTURI | IFS DESIG | SHATION OF | MILL | 4 |
| 1 DRILLING AGENCY USCE | | | <u></u> | | | NG 1500 | DUNDISTURBED | 4 |
| 4. HOLE NO. (As shown as d | erring cities | | 12. TOT | AL NO. OF | LES TAKE | IN DISTURBE | 0 | ١ |
| S. HAME OF DRILLER | | 8A3F-110 | 14. 707 | AL HUMBE | A CORE I | OXES | |] |
| BREWER | | | 16. ELE | VATION OF | | | ** |] |
| | | | M. DAT | E HOLE | 132 | 13/86 | 3/18/86 | 7 |
| A VERTICAL MINCLI | | DEG. PROM VERT | | VATION TO | | | | 1 |
| 7. THICKNESS OF OVERBUR | | 46.0 | | | | y FOR BORING | | 7 |
| 6. DEPTH BRILLED INTO R | ock | 192.0 | 19. SIGH | ATURE OF | INSPECT | OR / # | · · · · · · · · · · · · · · · · · · · | 7 |
| 9. TOTAL DEPTH OF HOLE | _ | 238.0 | <u> </u> | 1 CORE | BOX OR | Malla | REMARKS | ┨ |
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8A3F-110 DRILLING LOG OF 6 SHEETS FISHTAIL SOUTHWESTERN PORT WORTH GENERAL DYNAMICS 10. SIZE AND TYPE OF SITE "AUGER, 35 PALUXY AQUIPER "INVESTIGATION 12. MANUFACTURER'S DEMONATION OF ORILL
FA ILING 1500
TOTAL NO. OF OVER | DESTURBED USCE IL TOTAL NO. OF OVER-8A3F-110 HAME OF DRILLER 3/18/86 3/13/86 TOVERTICAL DINCLINED IT. ELEVATION TOP OF HOLE 7. THICKNESS OF OVERSURDEN 46.0 16. TOTAL CORE RECOVERY FOR BORING L DEPTH ORILLED INTO ROCK 192.0 238.0 CLASSIFICATION OF MATERIALS RECOV 200. visual ident. 220 7 visual ident. ENG FORM 1836 PREVIOUS EDITIONS ARE DESOLETE.

APPENDIX II

REPORTS OF MONITOR WELL ANALYTICAL RESULTS

RECEIVED

SEP 2 1 1985

BROWN AND CALDWELL ANALYTICAL LABORATORIES

MARGIS & ASSOCIATES, 1819.

LOG NO: P85-08-419

Received: 29 AUG 85 Reported: 18 SEP 85

David R. Hargis Hargis & Associates, Inc. 1735 East Fort Lowell Road, Suite 5 Tucson, Arizona 85719

Project: 250

REPORT OF ANALYTICAL RESULTS

| LOG NO | SAMPLE DESCRIPTION, GROUND WATER SA | MPLES | | DA' | TE SAMPLED |
|-------------|-------------------------------------|------------|---------------|----------------|-------------------------------------|
| | HI4-52 HM-53 P~11M | | | | 27 AUG 85 27 AUG 85 28 AUG 85 |
| PARAMETER | | | 08-419-2 | 08-419-3 | ** |
| Bage/Neutra | al Extractables | | | | |
| raction | n | 09/02/85 | 09/02/85 | 09/02/85 | |
| Date Analy | yzed | 09/14/85 | 09/15/85 | | |
| Benzidine | , ug/L | (40 | <40 | | |
| Dibutylph | thalate, ug/L | <50 | √5 0 | √50 | |
| Dimethylph | hthalate, ug/L | ₹25 | ₹25 | | |
| N-Nitroso | di-n-propylamine, ug/L | <40 | <40 | <40 | |
| N-Nitroso | dimethylamine, ug/L | ⟨80 | | <8 0 | |
| Naphthale | | <10 | 10 | - | |
| ûther Ba | se/Neutral Extractables, | <10 | <10 | <10 | |
| Semi-Quan | tified Results ** | | | | |
| Total C8- | -Cl5 Aromatic Compounds, ug/L | | 400 | | |

** Quantification based upon comparison of total ion count of the compound with that of the nearest internal standard.

LOG NO: P85-08-419

Received: 29 AUG 85 Reported: 18 SEP 85

David R. Hargis Hargis & Associates, Inc. 1735 East Fort Lowell Road, Suite 5 Tucson, Arizona 85719

Project: 250

| LOG NO | SAMPLE | DESCRIPTION, | GROUND | WATER | SAMPLES | | | DA | TE S | SAMPLED |
|----------------------------------|-------------------------|---------------|---------|-------|---------|------------|-----------|----------|------|----------------------------|
| 08-419-1 08-419-2 08-419-3 | HM-52 HM-53 P-11M | | | | | | | | 27 | AUG 85 AUG 85 AUG 85 |
| PARAMETER | 3,200 | | | | | 08-419-1 | 08-419-2 | 08-419-3 | | |
| Purgeable F | riority | Pollutants | | | | | | ** | | |
| raction | 1 | | | | | 09/08/85 | 09/08/85 | 09/08/85 | | |
| Acrolein, | ug/L | | | | | (10 | · <10 | <10 | | |
| Acrylonitr | ile, ug | /L | | | | ₹10 | <10 | <10 | | |
| Bromodichl | orometh. | ane, ug/L | | | | 2 | <1 | <1 | | |
| Chloroform | | • | | | | 3 | <1 | (1 | | |
| Trichloroe | | , ug/L | | | | 2 | (1 | (1 | | |
| Other Pur | geable | Priority Poll | utants, | | | (1 | (1 | (1 | | |

Componential Componential

PAGE 2 RECEIVED: 08/29/85

Analytical Serv REPORT Results by Sample

LAB # 85-08-171

| SAMPLE | SAMPLE ID P-11M | | | SAMPL | E # 01 | FRACTION | S: A, B | | | | |
|--------|-----------------|----------|-----------------|--------------------|-----------------|--------------------------------|---------------|----------------------------------|---------------|----------|---------|
| | | | | Date | & Time | Date & Time Collected 08/28/85 | 08/58/8 | • | Category | pro | |
| AS_GA | <. 002 | CA E | 54 | CD_E <. 002 CL_IC_ | (, 002 ug/m1 | 01 TO | 18 mg/L | 18 CO3 A (1,0 CR E mg/L as caco3 | (1.0 cac03 | S | ₹. 005 |
| CUE | K. 001 | ਜ਼ ਜ਼ | 0.028* ug/m1 | HCO3 A 263 | 263 Cacco | HG_CA < . 0002 K E | €. 0002 ug/m1 | X E | 5.6 MG E | 1 | 20 - 20 |
| NA E | 57 ug/m1 | PB GA | (, 002 ug/m1 | SE_GA | (, 005 ug/m1 | K. 005 S04 IC | 48 mg/L | 48 SR_E | 3.5 ug/m1 | | |

RECEIVED

SEP 1 4 1985

HARGIS & ASSOCIATES, INC.



ANALYTICAL LABORATORIES

LOG NO: P85-09-090

Received: 07 SEP 85 Reported: 12 SEP 85

David R. Hargis Hargis & Associates, Inc. 1735 East Fort Lowell Road, Suite 5 Tucson, Arizona 85719

Project: 250

REPORT OF ANALYTICAL RESULTS

| LOG NO | SAMPLE DESCRIPTION, AQUEOUS SAMPLES | | | DA | TE SAMPLED |
|----------------------------------|-------------------------------------|----------|----------|----------|-------------------------------------|
| 09-090-1 09-090-2 09-090-3 | P-11(M)) P-11(U) HM-84 | | | | 05 SEP 85 05 SEP 85 05 SEP 85 |
| PARAMETER | | 09-090-1 | 09-090-2 | 09-090-3 | |
| P 'eable | Priority Pollutants | | ******** | | |
| Lcractio | n | 09/11/85 | 09/11/85 | 09/11/85 | |
| Acrolein, | ug/L | <10 | <10 | <10 | |
| Acrylonit | rile, ug/L | <10 | <10 | <10 | |
| Methylene | Chloride, ug/L | <1 | 15 | 3 | |
| Toluene, | ug/L | <1 | 64 | (1 | |
| Other Pu | rgeable Priority Pollutants, | <1 | <1 | <1 | |

Edward Wilson, Laboratory Director

HARAIS & ASSOCIATES, INC.

ANALYTICAL LABORATORIES

LOG NO: P85-10-231

Received: 14 OCT 85 Reported: 01 NOV 85

Peter Quinlan Hargis & Associates, Inc. 2223 Avenida de la Playa Suite 300 La Jolla, CA 92037

Project: 250

| LOG NO | SAMPLE DESCRIPTION | , GROUND W | ater sample | S | · DA | TE SAMPLED |
|----------------------------------|---|------------|-------------|----------|----------|---|
| 10-231-2 10-231-3 10-231-4 | P-11U P-11M P-12 M HM-36 HM-37 | | | | | 10 OCT 85 10 OCT 85 10 OCT 85 11 OCT 85 10 OCT 85 |
| PARAMETER | | 10-231-1 | 10-231-2 | 10-231-3 | 10-231-4 | 10-231-5 |
| Purgeable Pr | iority Pollutants | | | | | |
| Extraction | | 10/24/85 | 10/24/85 | 10/25/85 | 10/23/85 | 10/25/85 |
| Acrolein, u | g/L | <10 | <10 | <10 | <10 | <100 |
| Acrylonitri | | <10 | <10 | <10 | <10 | <100 |
| | hylene, ug/L | <1 | <1 | <1 | 1 | 340 |
| Toluene, ug | | 70 | <1 | <1 | <1 | <10 |
| | ichloroethylene, u | g/L <1 | <1 | <1 | <1 | 9 0 |
| | eable Priority | (1 | (1 | <1 | <1 | <10 |

LOG NO: P85-12-201

Received: 13 DEC 85 Reported: 03 JAN 86

Peter T. Quinlan Hargis & Associates, Inc. 2223 Avenida de la Playa Suite 300 La Jolla, CA 92037

Project: 250

| LOG NO | SAMPLE DESCRIPTION , GROUND WATER S | SAMPLES | DA: | TE SAMPLED |
|--|---|--|--------------|---|
| | P-12U French Drain #1 Drain Pipe | | | 12 DEC 85 11 DEC 85 11 DEC 85 |
| PARAMETER | | 12-201-2 | 12-201-3 | |
| Extraction Date Analy 1,2-Dichlo 1,4-Dichlo 2,4-Dimeth 2,4-Dinity 2-Methylo 4-Nitropho Benzidine Dibutylpho Dimethylph N-Nitrosoo N-Nitrosoo Naphthale | yzed orobenzene, ug/L orobenzene, ug/L hylphenol, ug/L rophenol, ug/L 4,6-dintrophenol, ug/L enol, ug/L thalate, ug/L hthalate, ug/L di-n-propylamine, ug/L dimethylamine, ug/L | 12/16/85 12/19/85 <10 <10 <25 <50 <25 <40 <50 <25 <40 <10 | 67 | 12/16/85 12/20/85 130 18 10 <25 <50 <25 <40 <50 <25 <40 <10 |
| A Terpend Total C8- Total Un: | tified Results ** ol, ug/L -C35 Hydrocarbons, ug/L identified Compounds, ug/L hyl Butyl Phenol, ug/L | | 60 10 | 20 10,000 |

^{**} Quantification based upon comparison of total ion count of the compound with that of the nearest internal standard.

LOG NO: P85-12-201

Received: 13 DEC 85 Reported: 03 JAN 86

Peter T. Quinlan Hargis & Associates, Inc. 2223 Avenida de la Playa Suite 300 La Jolla, CA 92037

Project: 250

REPORT OF ANALYTICAL RESULTS

| LOG NO | SAMPLE DESCRIPTION , GROUND WATER S | AMPLES | DA | TE SAMPLED |
|---|--|--|--|---|
| | P-12U French Drain #1 Drain Pipe | | | 12 DEC 85 11 DEC 85 11 DEC 85 |
| PARAMETER | | 12-201-2 | 12-201-3 | 12-201-4 |
| Extraction 1,1,1-Tric 1,1-Dichlo Acrolein, Acrylonite Benzene, u Chlorobenz Ethylbenze Tetrachlor Trichloroe Toluene, u Vinyl Chlo trans-1,2- | chloroethane, ug/L proethylene, ug/L ug/L rile, ug/L ug/L ug/L ene, ug/L ene, ug/L coethylene, ug/L ethylene, ug/L | 12/21/85 <1 <10 <10 <1 <1 <1 <1 <1 <1 <1 <1 <1 <1 <1 <1 <1 | 12/20/85 23 15 <100 <100 <10 27 66 83 1000 250 2800 7500 <10 | 250 25 40 25 180 1200 950 11,000 |
| | ified Results ** somers, ug/L | | 45.40.40 | 100 |

** Quantification based upon comparison of total ion count of the compound with that of the nearest internal standard.

LOG NO: P85-12-201

Received: 13 DEC 85 Reported: 03 JAN 86

Peter T. Quinlan Hargıs & Associates, Inc. 2223 Avenida de la Playa Suite 300 La Jolla, CA 92037

Project: 250

| LOG NO | SAMPLE DESCRIPTION , | GROUND H | IATER | SAMPLE | S | ם | ATE SAMPLED |
|----------------------------------|--|----------|-------|--------|----------|----------|-------------------------------------|
| 12-201-2 12-201-3 12-201-4 | P-12U French Drain #1 Drain Pipe | | | | | | 12 DEC 85 11 DEC 85 11 DEC 85 |
| PARAMETER | | | | | 12-201-2 | 12-201-3 | 12-201-4 |
| Total Fuel Oil and Gre | Hydrocarbons, mg/L ase, mg/L | | | | (1 32 | (1 14 | 4 120 |

CORPORATION

PAGE 3 RECEIVED: 12/16/85

Analytical Serv Results by Sample

LAB # 85-12-073

| C; A | Date & Time Collected 12/12/85 Category | 0.48 CU E < .001 FE E 5.0 ug/m1 | 0.39 m1m/gu |
|-----------------|---|-----------------------------------|----------------|
| FRACTION | Collected | CR_E | SR_E |
| PLE # 04 | e & Time | (, 002 CR E | 0.010* |
| SAF | Dat | CD E | SE_GA_ |
| | | 0.003* | 0.004* |
| | | AS_GA | PB_GA |
| SAMPLE 10 HM-85 | | <. 002 ug/m1 | <. 0002 |
| SAMPLE | | AG_E | HG_CA |

| SAMPLE | SAMPLE ID P-12U | | | SAMPL | E # 05 | FRACTION | S: A, B | | | | |
|--------|-----------------------|-------|----------------|----------|----------------|--------------------------------|--------------------------------|--------|---------------------|---------------------------|-------------|
| | | | | Date | & Time | Date & Time Collected 12/12/85 | 12/12/8 | 5 | Category | ory | |
| AG E | <. 004 AS GA ug/m1 | AS_GA | 0.024 ug/m1 | CA E | 540 ug/m1 | 540 CD E <. 002 CL IC | <. 002 | 21 TO | 16 mg/L | 16 CO3 A (1 mg/L as CaCO3 | Cacos |
| CR_E | 0.18 ug/m1 | CU E | 0.093 | <u> </u> | 77 ug/m1 | | HCO3 A 174 HG CA mg/L as Caco3 | HG_CA | <. 0002 K E ∪ 09/m1 | ¥ | 15 July 123 |
| 9 E | 38 ug/m1 | NA E | 44 ug/m1 | PB_GA | 0, 10 ug/ml | 0, 10 SE GA 0, 016* 504 IC | 0.016* ug/ml | 504_IC | 7/6w | 45 SR E | 4.3 |

LOG NO: P86-01-154

Received: 10 JAN 86 Reported: 23 JAN 86

Peter T Quinlan Hargis & Associates, Inc. 2223 Avenida de la Playa Suite 300 La Jolla, CA 92037

Project: 250

| LOG NO | SAMPLE DESCRIPTION | ON , GROUND W | ater sample | S | DA | TE SAMPLED |
|--|---|------------------------|------------------------------------|------------------------------------|------------------------------------|---|
| | P-10 Upper P-10 Middle P-11 Upper P-11 Middle P-12 Middle | | | | | 08 JAN 86 08 JAN 86 09 JAN 86 09 JAN 86 09 JAN 86 |
| PARAMETER | | 01-154-11 | 01-154-12 | 01-154-13 | 01-154-14 | 01-154-15 |
| Extraction Acrolein, Acrylonita trans-1,2- | ug/L rile, ug/L -Dichloroethylene, rgeable Priority | 01/13/86 <10 <10 | 01/13/86 <10 <10 <1 <1 | 01/13/86 <10 <10 <1 <1 | 01/13/86 <10 <10 <1 <1 | 01/14/86 <10 <10 <1 <1 |

LOG NO: P86-01-154

Received: 10 JAN 86 Reported: 23 JAN 86

Peter T Quinlan Hargıs & Associates, Inc. 2223 Avenida de la Playa Suite 300 La Jolla, CA 92037

Project: 250

| LOG NO | SAMPLE DESCRIPTION , GROUND WATE | R SAMPLES | DATE SAMPLED |
|-------------|----------------------------------|----------------------|--------------|
| 01-154-24 | P-12 Upper | | 09 JAN 86 |
| PARAMETER | | 01-154-24 | |
| Oil and Gre | | 9 | |
| Total Fuel | Hydrocarbons, mg/L | (1 | |
| Purgeable P | riority Pollutants | | |
| Extraction | l | 01/14/86 | |
| 1,1,1-Tric | hloroethane, ug/L | 62 | |
| Acrolein, | ug/L | <10 | |
| Acrylonita | ile, ug/L | <10 | |
| | geable Priority Pollutants, | <1 | |
| | Priority Pollutants | | |
| Extraction | | ù1/13/8 6 | |
| Date Analy | zed | Ul/16/86 | |
| | ophenol, ug/L | ₹25 | |
| | , 6-dintrophenol, ug/L | ₹50 | |
| 4-Nitrophe | | ₹25 | |
| Benzidine, | ug/L | ₹40 | |
| Dibutylpht | chalate, ug/L | ₹50 | |
| | thalate, ug/L | √2 5 | |
| N-Nitrosod | i-n-propylamine, ug/L | ₹40 | |
| | imethylamine, ug/L | <8 0 | |
| | ,A Ext. Priority Pollutants, | <10 | |

E PERMINE

PAGE 3 RECEIVED: 01/13/86

Analytical Serv REPORT Results by Sample

LAB # 86-01-044

| SAMPLE | SAMPLE ID P-12 upper | 00er | | SAMPL | E # 05 | FRACTIONS | 3. A. B | | | | |
|---------------|----------------------|---------|--------|---------|--------|--------------------------------|---------|-------|------------------|-------------|---------|
| | | | | Date | & Time | Date & Time Collected 01/09/86 | 01/09/8 | .0 | Category | org | |
| AG E | 0.005* A | AS_GA | <. 003 | CA E | 41 | 41 CD E C. 002 CL IC | <. 002 | 21 73 | | 11 CO3 A <1 | |
| | ug/m] | | ug/m] | | ug/m] | | lm/go | | A9 /L | # 7/6# | s cacus |
| ш Ж | 0.006* C | CU E | 0.012 | FI T | 1.6 | 1.6 HC03 A 225 | 225 | HG CA | HG CA (.0002 K E | X M | 6.5 |
| 1 | ug/ml | í | ug/m1 | | ug/m1 | mg/L as | caco3 | | ug/m1 | | UG/#1 |
| ш <u>2</u> | 13 | 13 ME | 0.076 | NA E | 44 N | NO3 IC <. 2 PB GA 0.007* | ر د | PB GA | 0.007* | SE GA | ₹. 003 |
| | ug/ml | | 1m/6n | | lm/gu | | J/Bm | | ug/ml | | ug/m1 |
| 1 S04 IC | 47 | 47 SR E | 2.6 | ZN E | 1.5 | | | | | | |
| | mg/L | | ug/ml | | ug/ml | | | | | | |

LOG NO: P86-04-079

Received: 04 APR 86 Reported: 22 APR 86

David R. Hargis Hargis & Associates, Inc. 2223 Avenida de la Playa Suite 300 La Jolla, CA 92037

Project: 250

| LOG NO | SAMPLE DESCRIPTION | , GROUND W | ATER SAMPLE | S | DA | TE SAMPLED |
|------------------------|---|------------|-------------|--------------|--------------|---|
| 04-079-27 | P-9 Middle P-10 Upper P-10 Middle P-11 Middle French Drain #1 | | | | | 02 APR 86 03 APR 86 03 APR 86 02 APR 86 03 APR 86 |
| PARAMETER | | 04-079-24 | 04-079-25 | 04-079-26 | 04-079-27 | 04-079-28 |
| Purgeable F | Priority Pollutants | | | | , | |
| Extraction | l | 04/14/86 | 04/14/86 | 04/14/86 | 04/14/86 | 4/15/86 |
| 1,1,1-Tric | hloroethane, ug/L | <1 | (1 | <1 | <1 | 89 |
| Acrolein, | ug/L | <10 | <10 | <10 | <10 | ₹500 |
| Acrylonitr | ile, ug/L | <10 | <10 | <10 | <10 | <500 |
| Chloroform | ı, ug/L | (1 | (1 | <1 | <1 | 59 |
| Tetrachlor | oethylene, ug/L | <1 | <1 | <1 | <1 | 210 |
| Trichloroe | thylene, ug/L | (1 | a | <1 | <1 | 4200 |
| Vinyl Chlo | ride, ug/L | <1 | (1 | (1 | (1 | 1300 |
| trans-1,2- | Dichloroethylene, u | g/L <1 | 4 | (1 | (1 | 24,000 |
| Other Pur Pollutant | geable Priority | (1 | (1 | <1 | <1 | < 50 |

LOG NO: P86-04-128

Received: 08 APR 86 Reported: 25 APR 86

Peter T Quinlan Hargis & Associates, Inc. 2223 Avenida de la Playa Suite 300 La Jolla, CA 92037

Project: 250

| LOG NO | SAMPLE DESCRIPTION | , GROUND W | NATER SAMPLE | S. | DA | TE SAMPLED |
|------------|---------------------|------------|--------------|-----------|-----------|------------|
| 04-128-37 | HM-92 | | | | | 07 APR 86 |
| 04-128-38 | P-2 | | | | | 05 APR 86 |
| 04-128-39 | P-3 | | | | | 06 APR 86 |
| 04-128-40 | P-11 Upper | | | | | 05 APR 86 |
| 04-128-41 | P-12 Upper | | | | | 06 APR 86 |
| PARAMETER | | 04-128-37 | 04-128-38 | 04-128-39 | 04-128-40 | 04-128-41 |
| • | Priority Pollutants | | | | | |
| Extraction | 1 | 4/17/86 | 4/17/86 | 4/17/86 | 4/18/86 | 4/18/86 |
| 1,1,1-Tric | chloroethane, ug/L | <1 | <1 | <1 | <1 | 56 |
| Acrolein, | | <10 | <10 | <10 | <10 | <10 |
| Acrylonit | _ | <10 | <10 | <10 | <10 | <10 |
| Chloroform | | 2 | <1 | 2 | <1 | ⟨1 |
| Toluene, u | | 2 | (1 | 8 | (1 | <1 |
| | geable Priority | (1 | (1 | <1 | (1 | <1 |
| Pollutant | 18, | | | | | |

LOG NO: P86-04-128

Received: 08 APR 86 Rep rted: 25 APR 86

Peter T Quinlan Hargis & Associates, Inc. 2223 Avenida de la Playa Suite 300 La Jolla, CA 92037

Project: 250

REPORT OF ANALYTICAL RESULTS

| LOG NO | SAMPLE DESCRIPTION , GROUND WATER | SAMPLES | D# | TE SAMPLED |
|-------------------------------------|---|-----------|-----------|-------------------------------------|
| 04-128-42 04-128-43 04-128-44 | P-12 Middle Cooling Tower Influent Cooling Tower Effluent | | | 06 APR 86 06 APR 86 06 APR 86 |
| PARAMETER | | 04-128-42 | 04-128-43 | 04-128-44 |
| Purgeable P | riority Pollutants | ~ | | |
| Extraction | | 4/18/86 | 4/18/86 | 4/18/86 |
| 1,1,1-Tric | hloroethane, ug/L | . (1 | 51 | 3 |
| 1,1-Dichlo | roethylene, ug/L | . (1 | 14 | <1 |
| Acrolein, | ug/L | <10 | <100 | <10 |
| Acrylonitr | ile, ug/L | (10 | <100 | <10 |
| Chloroform | , ug/L | (1 | 12 | <1 |
| Tetrachlor | oethylene, ug/L | (1 | 29 | 2 |
| | thylene, ug/L | <1 | 1800 | 94 |
| Vinyl Chlor | ride, ug/L | (1 | 150 | <1 |
| trans-1,2-1 | Dichloroethylene, ug/L | (1 | 3000 | 150 |
| | geable Priority Pollutants, | (1 | <10 | <1 |

Edward Wilson, Laboratory Director

LOG NO: P86-04-220

Received: 10 APR 86 Reported: 15 MAY 86

Sam Williams Hargis & Associates, Inc. 2223 Avenida de la Playa Suite 300 La Jolla, CA 92037

Project: 250

| LOG NO | SAMPLE DESCRIPTION , GROUND WAT | ER SAMPLES | DATE SAMPLED |
|--------------------------|---------------------------------|------------|--------------|
| 04-220-6 | P-13 Upper | | 09 APR 86 |
| PARAMETER | | 04-220-6 | |
| Oil and Great Alkalinity | ase, mg/L | <5 | |
| Carbonate A | Alk (as CaCO3), mg/L | 40 | |
| Bicarb Alk | (as CaCO3), mg/L | 210 | |
| Hydroxide i | Alk (as CaCO3), mg/L | 0 | |
| Other Alk | alinity, | <10 | |
| Total Fuel ! | Hydrocarbons, mg/L | (1 | |
| | riority Pollutants | | |
| Extraction | ▼ | 04/20/86 | |
| Acrolein, | ug/L | <10 | |
| Acrylonitr: | | <10 | |
| | geable Priority Pollutants, | (1 | |

LOG NO: P86-04-220

Received: 10 APR 86 Reported: 15 MAY 86

Sam Williams Hargis & Associates, Inc. 2223 Avenida de la Playa Suite 300 La Jolla, CA 92037

Project: 250

| LOG NO | SAMPLE DESCRIPTION , GROUND WATER | R SAMPLES | DATE SAMPLED |
|------------|-----------------------------------|---------------|--------------|
| 04-220-6 | P-13 Upper | | 09 APR 86 |
| PARAMETER | | 04-220-6 | |
| B/N,A Ext. | Priority Pollutants | | |
| Extraction | ı | 4/14/86 | |
| Date Analy | zed | 4/17/86 | |
| 2,4-Dinitr | ophenol, ug/L | <25 | |
| Z-Methyl-4 | ,6-dintrophenol, ug/L | <50 | |
| 4-Nitrophe | nol, ug/L | ₹25 | |
| Benzidine, | ug/L | . <40 | |
| Dibutylpht | halate, ug/L | <50 | |
| Dimethylph | thalate, ug/L | ⟨25 | |
| N-Nitrosod | i-n-propylamine, ug/L | <40 | |
| N-Nitrosod | imethylamine, ug/L | <80 | |
| Other B/N | ,A Ext. Priority Pollutants, | <10 | |

LOG NO: PB6-04-220

Received: 10 APR 86 Reported: 15 MAY 86

Sam Williams Hargis & Associates, Inc. 2223 Avenida de la Playa Suite 300 La Jolla, CA 92037

Project: 250

| LOG NO SAMPLE DESCRIPTION , GROUND WATER SAMPLES | DATE SAMPLED |
|--|---------------|
| 04-220-6 P-13 Upper | OSS NOTE: RIG |
| | 1-220-6 |
| Magnesium, mg/L | <0.067 |
| Copper, mg/L | <0.02 |
| Iron, mg/L | <0.2 |
| Manganese, mg/L | <0.01 |
| Potassium, mg/L | 20 |
| Sodium, mg/L | · 81 |
| Zinc, mg/L | 0.21 |
| · | 0.0075 |
| | <0.009 |
| | 0.0005 |
| | 0.0056 |
| Strontium, mg/L | 2.9 |
| Chromium, mg/L | <0.03 |
| Lead, mg/L | 0.038 |
| | /29/86 |
| Calcium (EDTA Titration), mg/L | 170 |
| Chloride, mg/L | 240 |
| Surfactants, mg/L | <0.1 |
| pH, Units | 11.5 |
| Sulfate, mg/L | 26 |
| Specific Conductance, umhos/cm | 1600 |
| Filterable Residue (TDS), mg/L | 720 |
| Nitrate (as NO3), mg/L | <4 |

LOG NO: P86-05-179

Received: 09 MAY 86 Reported: 10 JUN 86

Peter Quinlan Hargis & Associates, Inc. 2223 Avenida de la Playa Suite 300 La Jolla, CA 92037

Project: 250

| DATE SAMPLED | |
|--------------|--|
| 08 MAY 86 | |
| | |
| | |
| | |
| | |
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| | |
| •• | |
| • | |
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4100 PIERCE RD., BAKERSFIELD, CALIFORNIA 93308 PHONE 327-4911

Hargis & Associates, Inc. 2223 Avenue De La Playa, Suite 300

Date Reported: 6/12/86 Date Received: 5/9/86

La Jolla, California 92037

Laboratory No.: 7140

Attention: Alan Wylie

Job #250

WATER ANALYSIS

Sample Description: 5/7/86 Well P-12 Upper 20:20

| Constituents | mg/liter |
|---|---|
| Iron Manganese Arsenic Copper Zinc Barium Cadmium Total Chromium Lead Mercury Selenium Silver Antimony Beryllium Nickel | 0.13 9.06 (-) 0.01 (-) 0.01 0.41 (-) 0.5 (-) 0.005 (-) 0.01 (-) 0.002 (-) 0.005 (-) 0.01 (-) 1.0 (-) 0.01 (-) 0.01 (-) 0.01 (-) 0.05 |
| Thallium Molybdenum Strontium | (-) 0.5 (-) 0.1 1.6 |

(-) refers to "less than"

B C LABORATORIES, INC.

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JUN 1 3 '86

HARGIS + ASSOCIATES, INC. LA JOLLA, CA

PETROLEUM

I ABORATORIES, INC.

J. J. EGLIN, REG. CHEM. ENGR.

4100 PIERCE RD., BAKERSFIELD, CALIFORNIA 93308 PHONE 327-4911

Hargis & Associates, Inc.

1735 East Fort Lowell Road, Suite 5

Tucson, Arizona 85719

Date Reported: 6/12/86 Date Received: 5/9/86 Laboratory No.: 7141

Attention: Alan Wylie Job # 250

WATER ANALYSIS

Sample Description: 5/7/86 Well P-13 Upper 18:40

| Constituents Hydroxide | epm 3.28 | mg/liter 45.9 |
|--------------------------------|-------------|------------------|
| Calcium | 6.00 | 120. |
| Magnesium | 0.00 | 0.03 |
| Sodium | 3.39 | 78. |
| Potassium | 0.54 | 21. |
| Carbonate | 1.45 | 43.4 |
| Bicarbonate | 0. | 0. |
| Chloride | 4.12 | 146. |
| Sulfate | 1.06 | 51. |
| Nitrate | (-) 0.01 | 0.4 |
| Fluoride | () 0.01 | 0.55 |
| Iron . | | 0.64 |
| Manganese | ٠. | . 0.06 |
| Arsenic | | (-) 0.01 |
| Copper | · | 0.14 |
| Zinc | | 4.4 |
| Total Dissolved Solids @ 180°C | | 710. |
| Barium | | (-) 0.5 |
| Cadmium | | (-) 0.005 |
| Total Chromium | | (-) 0.01 |
| Lead | | 0.17 |
| Mercury | | (-) 0.0002 |
| Selenium | | (-) 0.005 |
| Silver | | (-) 0.01 |
| Boron | | (-) 0.10 |
| Silica | | 18. |
| Antimony | | (-) 1.0 |
| Beryllium | | (-) 0.01 |
| Nicke! | | (-) 0.05 |
| Thallium | | (-) 0.5 |
| Molybdenum | | (-) 0.1 |
| Strontium | | 1.1 |
| | | |

PH Electrical Conductivity, Micromhos/cm

(-) refers to "less than"

B C LABORATORIES, INC.

BY 5. J. Eglin

11.1 1,550.

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JUN 1 3 '86

HARGIS + ASSOCIATES, INC. LA JOLLA, CA

CORPORATION

Uark Order # 85-05-094 Austin Results by Sample Res Page a Received: 05/09/86

| FE E 0.17 SAMPLE # 02 FRACTIONS: A SAMPLE # 02 FRACTIONS: A FE E 9.9 SAMPLE # 03 FRACTIONS: A SAMPLE # 03 FRACTIONS: A FE E 4.5 FE E 4.5 |
|--|
| SAMPLE ID HM-85 Catenory |

3.6

LOG NO: P86-06-142

Received: 09 JUN 86 Reported: 07 JUL 86

Peter Quinlan Hargis & Associates, Inc. 2223 Avenida de la Playa Suite 300 La Jolla, CA 92037

Project: 250

| LOG NO | SAMPLE DESCRIPTION , GROUND | WATER SAMPLE | :S | DA | TE SAMPLED |
|-------------|---|--------------|-----------|-----------|--|
| 06-142-18 | HM-21 HM-30 HM-53 P-13 Upper | | | | 05 JUN 86 04 JUN 86 04 JUN 86 05 JUN 86 |
| APAMETER | • | 06-142-16 | 06-142-17 | 06-142-18 | 06-142-19 |
| Oil and Gre | • | | <5 | (5 | √5 |
| Total Fuel | Hydrocarbons, mg/L Priority Pollutants | | (1 | 2 | <1 |
| Extraction | • | | | | 06/11/86 |
| Date Analy | zed | | | | 06/13/86 |
| 2,4-Dinitr | ophenol, ug/L | | | | ₹25 |
| 2-Methy1-4 | ,6-dintrophenol, ug/L | | | | €50 |
| 4-Nitrophe | nol, ug/L | | | | ₹ 25 |
| Benzidine, | - | | | | 440 |
| Dibutylpht | halate, ug/L | | | | <50 |
| Dimethylph | thalate, ug/L | | | | ₹25 |
| N-Nitrosod | i-n-propylamine, ug/L | | | | (40 |
| N-Nitrosod | imethylamine, ug/L | | | | ₹80 |
| Other B/N | ,A Ext. Priority Pollutants, | | | | <10 |

LOG NO: P86-06-142

Received: 09 JUN 86 Reported: 07 JUL 86

Peter Quinlan Hargis & Associates, Inc. 2223 Avenida de la Playa Suite 300 La Jolla, CA 92037

Project: 250

REPORT OF ANALYTICAL RESULTS

| LOG NO | SAMPLE DESCRIPTION , GROUND WATER SAMPLES | | | DATE SAMPLED | |
|-------------|---|-----------|-----------|--------------|-----------|
| 06-142-16 | HM-21 | | | | 05 JUN 86 |
| 06-142-17 | HM-30 | | | | 04 JUN 86 |
| 06-142-18 | HM-53 | | | | 04 JUN 86 |
| 06-142-19 | P-13 Upper | | | | 05 JUN 86 |
| PARAMETER | | 06-142-16 | 06-142-17 | 06-142-18 | 06-142-19 |
| Purgeable F | Priority Pollutants | | | | |
| Extraction | 1 | 06/14/86 | | | 06/14/86 |
| Acrolein, | ug/L | < 500 | | | <10 |
| Acrylonitr | rile, ug/L | <500 | | | <10 |
| trans-1,2- | Dichloroethylene, ug/L | 3850 | | | <1 |
| Other Pur | rgeable Priority Pollutants, | <50 | | | α |

Edward Wilson, Laboratory Director

PETROLEUM .

_ABORATORIES, INC.

J. J. EGLIN, REG. CHEM. ENGR.

4100 PIERCE RD., BAKERSFIELD, CALIFORNIA 93308 PHONE 327-4911

Hargis & Associates

1735 East Fort Lowell Road, Suite 5

Tucson, Arizona 85719 Attention: Sam Williams Date Reported: 7/1/86 Date Received: 6/9/86

Laboratory No.: 8934

Job 250

WATER ANALYSIS

Sample Description: General Dynamics #250 6/5/86 P-13 Upper SW/CR 16:00

| Constituents | epm | mg/liter |
|-------------------------|----------|-------------------|
| Hydroxide | 3.46 | 58.8 |
| Calcium | 4.40 | 88. |
| Magnesium | 0.01 | 0.08 |
| Sodium | 3.00 | 69. |
| Potassium | 0.38 | 15. |
| Carbonate | 1.02 | 30.7 |
| Bicarbonate | 0. | 0. |
| Chlo <i>c</i> ide | 2.01 | 71.1 |
| Sulfate | 1.40 | 67. |
| Nitrate | (4) 0.01 | (4) 0.4 |
| Fluoride | | 0.44 |
| Iron | | 0.16 |
| Manganese | | 0.01 |
| Arsenic | • | (4) 0.01 |
| Copper | | 0.02 |
| Zinc | | 1.4 |
| Total Dissolved Solids | @ 180°C | 490. |
| Barium | | (4) 0.5 |
| Cadmium | | (4) 0.005 |
| Total Chromium | | (4) 0.01 |
| Lead | | 0.06 |
| Mercury | | (4) 0.0002 |
| Selenium | | (4) 0.005 |
| Silver | | (4) 0.01 |
| Boron | | (4) 0.10 |
| Silica | | 22. |
| Antimony | | (4) 1.0 |
| Beryllium | | (4) 0.01 |
| Nickel | | (4) 0.05 |
| Thallium | | (4) 0.5 |
| Molybdenum | | (4) 0.1 |
| Strontium | | 0.9 |
| Electrical Conductivity | ·, | |
| Micromhos/cm @ 25 °C | | 730. |
| рH | | 10.8 |
| - | | |

B C LABORATORIES, INC.

BY L. J. Glid

LOG NO: P86-07-212

Received: 11 JUL 86 Reported: 29 JUL 86

Peter Quinlan Hargis & Associates, Inc. 2223 Avenida de la Playa Suite 300 La Jolla, CA 92037

Project: 250

| LOG NO | SAMPLE DESCRIPTION | , GROUND N | ATER SAMPLE | S | DA | TE SAMPLED |
|---|--|------------------------------|------------------------------------|------------------------------------|-------------------------------------|---|
| 07-212-20 07-212-21 07-212-22 07-212-23 07-212-24 | P-9 Upper P-9 Middle P-11 Upper P-11 Middle P-12 Upper | | | | | 10 JUL 86 10 JUL 86 10 JUL 86 10 JUL 86 09 JUL 86 |
| PARAMETER | | 07-212-20 | 07-212-21 | 07-212-22 | 07-212-23 | 07-212-24 |
| Extraction 1,1,1-Tric Acrolein, Acryloniti | chloroethane, ug/L ug/L rile, ug/L rgeable Priority | 07/21/86 (1 (10 (10 | 07/22/86 <1 <10 <10 <1 | 07/22/86 <1 <10 <10 <1 | 07/22/86 <1 <10 <10 <10 | 07/22/86 7 <10 <10 <1 |

LOG NO: P86-07-212

Received: 11 JUL 86 Reported: 29 JUL 86

Peter Quinlan Hargis & Associates, Inc. 2223 Avenida de la Playa Suite 300 La Jolla, CA 92037

Project: 250

| LOG NO SAMPL | SAMPLE DESCRIPTION , GROUND WATER SAMPLES | | | | | DATE SAMPLED | |
|---|---|--|---|---|---|---|--|
| 07-212-25 P-12 07-212-26 P-13 07-212-27 P-41 07-212-28 P-48 07-212-29 P-60 | Middle Upper | | | | | 09 JUL 86 09 JUL 86 09 JUL 86 09 JUL 86 09 JUL 86 | |
| PARAMETER | · 07-2] | 12-25 | 07-212-26 | 07-212-27 | 07-212-28 | 07-212-29 | |
| Purgeable Priorit Extraction 1,1,1-Trichloroe 1,1,2,2-Tetrachl 1,1-Dichloroetha 1,1-Dichloroetha 1,3-Dichloroprop Acrolein, ug/L Acrylonitrile, u Bromodichloromet Benzene, ug/L Chloroform, ug/L Ethylbenzene, ug Trichloroethylen Toluene, ug/L trans-1,2-Dichlo trans-1,3-Dichlo Other Purgeable | thane, ug/L oroethane, ug/L ne, ug/L lene, ug/L ne, ug/L ene, ug/L ene, ug/L /L e, ug/L roethylene, ug/L ropropene, ug/L | 22/86 5 (1 2 (1 (1) (1) (1) (1) (1) (1) (1) (1) (1) | 07/22/86 (1 (1 (1 (1 (1) (1) (1) (1) (1) (1) (1 (1) (1) | 07/23/86 51 20 <10 17 17 15 <100 <100 21 33 <10 14 930 16 1400 19 <10 | 07/22/86 30 <10 <10 <10 <10 <100 <100 <100 <100 | 07/22/86 20 <10 <10 17 <10 <100 <100 <100 <100 <10 | |

LOG NO: P86-08-106

Received: 07 AUG 86 Reported: 28 AUG 86

Sam Williams
Hargis & Associates, Inc.
2223 Avenida de la Playa Suite 300
La Jolla, CA 92037

Project: 250

Page 4

| LOG NO SAMPLE DESCRIPTION | , GROUND WA | ATER SAMPLES | 5 | D/ | TE SAMPLED |
|--|-------------|---------------|-----------|-----------|---|
| 08-106-16 Radar Range Seep 08-106-17 C-3 08-106-18 C-5 08-106-19 HM-21 08-106-20 P-13M | | | | | 06 AUG 86 06 AUG 86 06 AUG 86 06 AUG 86 06 AUG 86 |
| PARAMETER | 08-106-16 | 08-106-17 | 08-106-18 | 08-106-19 | 08-106-20 |
| Oil and Grease, mg/L Total Fuel Hydrocarbons, mg/L B/N,A Ext. Priority Pollutants | ••• | < 5 | <5 | | <5 <1 |
| Extraction | | | *** | | 08/14/86 |
| Date Analyzed 2,4-Dinitrophenol, ug/L | • | | *** | | 08/25/86 < 25 |
| 2-Methyl-4,6-dintrophenol. us/ | L | | | ••• | <5 0 |
| 4-Nitrophenol, ug/L Benzidine, ug/L | | | *** | | <25 <40 |
| Dibutylphthalate, ug/L | ••• | | ••• | ••• | < 50 |
| Dimethylphthalate, ug/L N-Nitrosodi-n-propylamine, ug/ | 1 | ••• | • • • | ••• | <25 <4 0 |
| N-Nitrosodimethylamine, ug/L | | ••• | ••• | ••• | <8 0 |
| Other B/N, A Ext. Priority Pol | lutants | • • • | | ••• | <10 |

LOG NO: P86-08-106

Received: 07 AUG 86 Reported: 28 AUG 86

Sam Williams Hargis & Associates, Inc. 2223 Avenida de la Playa Suite 300 La Jolla, CA 92037

Project: 250

| | REP | ORT OF ANAL | YTICAL RESU | JLTS | | Page 6 |
|---|--|-------------|--|---|--|---|
| LOG NO | SAMPLE DESCRIPTION | , GROUND WA | TER SAMPLES | 5 | DA | ATE SAMPLED |
| 08-106-19 | Radar Range Seep C-3 C-5 HM-21 P-13M | | | | | 06 AUG 86 06 AUG 86 06 AUG 86 06 AUG 86 06 AUG 86 |
| PARAMETER | | 08-106-16 | 08-106-17 | 08-106-18 | 08-106-19 | 08-106-20 |
| Extraction Acrolein, Acrylonitr Toluene, u trans-1,2- | ug/L ile, ug/L | | 08/16/86 <10 <10 <1 <1 <1 | 08/16/86 <10 <10 150 <1 <1 | 08/16/86 <250 <250 <25 4400 <25 | 08/16/86 <10 <10 <1 <1 <1 |

Edward Wilson, Laboratory Director

DATE ILMED